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INDIVIDUAL DIFFERENCES IN LEARNING TO USE A WORD PROCESSING SYSTEM

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MEMORANDUM

I certify that this dissertation is based on my own independent work except where otherwise acknowledged and stated in the text.

Signed

Sarah B Barnes ______ Sarah Butler Barnes

ABSTRACT

The efficient use of a word processing system can be viewed as a combination of four factors: factors common to all types of learning, factors specific to word processing tasks, factors specific to the sample being studied, and factors or individual differences that were not measured in the present study.

Previous research on the acquisition of word processing skills has focused on the limitations of the systems under investigation or the training strategies used. This study departs from previous research and focuses on how the personal characteristics of the users affect their use of the word processing system.

Learning to use a word processing system is viewed within the framework of an information processing approach to learning.

This study describes a short-term longitudinal investigation of university secretaries learning to use Microsoft Word 5.

Thirty-one secretaries participated in a four week study which included the carrying out of editing tasks using Microsoft Word 5. Background characteristics, approaches to learning, conditions for learning, and scores on the Eysenck Personality Questionnaire were also elicited from the subjects. Statistical analyses (including repeated measures ANOVAs, factor analyses, and cluster analysis) were carried out to explore individual differences in efficient use of the word processing system and to investigate styles of word processing use.

The results suggest that though all secretaries made progress through the course of this investigation, none of them had reached a level of expert use of Microsoft Word 5 and the majority were still 'finding their way'. Styles of word processing use were related to characteristics of the individuals' personal backgrounds and personality. There was no evidence to support the notion of the need for optimal conditions for learning as proposed by adult learning theories.

DEDICATION

I dedicate this thesis to Bill and Marion Kessen, Edie MacMullen and Katherine Nelson with love and thanks.

For never giving up on me over all these years and for being the warm, caring people they are.

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INTRODUCTION

This dissertation describes a short-term longitudinal investigation of 31 university secretaries learning to use Microsoft Word 5 within their normal working environment. The context within which the investigation is placed involves its relationship with other studies exploring the use of word processing and text editing systems (Chapter 1); theories of perceptual-motor and cognitive skill relevant to the learning of computer tasks (Chapter 2); theories of adult learning, styles of learning and characteristics of learners which will affect their ability to learn (Chapter 3); the method and procedures used in this longitudinal investigation (Chapter 4); descriptive results of the surveys and experimental data (Chapter 5); statistical results on measures of group performance and efficiency (Chapter 6); results of statistical analyses exploring individual differences in learning to use Word 5 (Chapter 7); and finally, a discussion of the results in light of research studies and theories reviewed in Chapters 1 through 3 (Chapter 8).

Learning any new skill is complex. To do so, the learner must be motivated to learn must have an idea about what is to be learned and must have some idea about how to go about the process. Learning to use a computer package is unlike the learning of other skills because:

> In the computer learning situation we usually encounter adults who are experts at a particular task, who want to go on being experts at this task and who want to perform it as well as possible. They are usually not particularly interested in the computer system for any reason except that it may help them to improve their performance of the central task. (Waern, 1987, 275).

Another reason why learning to use computers is different is that it does not relate easily to anything else. There is a keyboard, like a typewriter, but the similarities are superficial. This makes it difficult for adults to relate this new learning experience to anything relevant in their past experiences.

This dissertation explores how secretaries learn to use a word processing system. These secretaries vary enormously in their secretarial backgrounds, training, work experiences, and personalities. What they all have in common is their employment by the University and being at a novice stage of learning Microsoft Word 5. Some of them are quite experienced both with computers, in general, and with word processing packages, in particular. Others have never used a word processing package, and of these there are a few who have never used a computer at all.

Their methods of learning to use a word processing system are expected to vary. Some will learn by memorizing enough techniques to manage most of their usual activities; others will delve deep into understanding the connections between the keys they press and the actions they produce.

To examine how these secretaries learn we need first to look at how people learn anything and then focus on the more specific activities associated with cognitive and perceptual-motor skill learning.

MOTOR SKILLS, COGNITIVE SKILLS AND ADULT LEARNING

Learning to use computers, and word processing skills in particular, involves acquiring both motor-skill and cognitive skills. The motor skills needed include eye-hand coordination and use of the keyboard and visual display unit (vdu). The cognitive skills needed include learning the rules and techniques of word processing and matching these to manuscript layouts.

Most secretaries acquiring word processing skills come to the task already skilled in typing. One of the initial differences to confront novice computer users is the keyboard. The major keyboard difference between typing and word processing is the inclusion of function keys (either by the side of the QWERTY keyboard or on a line across the top) as well as several cursor control keys (such as home, pageup and arrow keys) and special action keys (such as the control, alt, break keys). One of the first tasks for the new computer user is to find ways of integrating typing skills to include the additional function and specialist keys. Learning to use these special keys is a motor skill activity which incorporates brain function with finger coordination to reach the appropriate key. The typist is used to having all keys within reach from the standard hand position. In the days of the manual typewriter it was only to return the carriage that a typist would move her left hand from the standard rest position. The advent of the electric typewriter changed the way the carriage was returned to a new key incorporated into the QWERTY keyboard. This change meant that typists' hands no longer needed to be lifted from the keyboard. To make full use of computers, however, the operator's hand positions remain less static during editing and layout periods of work in order to reach the specialist function keys. Standard hand positions are maintained only during initial text input periods.

This change in keyboard layout to incorporate all the differing function keys can be seen as a major change for the operator. Not only will hand positions be affected but peripheral vision will be necessary (especially during the initial acquisition stages) to view all the keys available for use. Skilled users will be unable to rely solely on touch (as the proficient typist could) because of the distances involved between hand positions and keys.

Another visual skill needed involves the vdu screen. Most typists are taught not to look at the keyboard but rather to concentrate on the text they are typing from and the text being produced. In order to anticipate when to return the carriage (either through the lever on manual typewriters or the enter key on electric typewriters) it is necessary for typists to watch and listen for the bell to signal the end of a line. On a computer all output appears on a screen. Word processing packages almost universally now include a facility called wordwrap. Wordwrap does away with having to enter manually a carriage return. The computer does it automatically. This means that typists no longer need to watch or listen for the end of the line to come.

On a typewriter the paper moves through the machine and typists become quite proficient at knowing when they are reaching the end of a page. On a computer text scrolls up the screen in one long continuous sheet. Many word processing packages only segment text into pages just prior to printing. Therefore, on a computer it is not necessary to pay attention to page lengths as it was for the typist. The skills involved with learning where to look at the screen and to notice the change in location of the cursor, especially during editing sessions, is quite an important visual skill to master. Novices may regard the vdu as similar to a television screen and so try to take the whole picture in at once. However, when looking at text it quickly becomes clear that it might still be difficult for some people to learn to know where to look or to anticipate where the cursor will go depending on which key is pressed. It already seems apparent from this rudimentary analysis, that skilled typists need to unlearn some of their acquired habits to become proficient users of word processing systems.

The integration of motor skill with the cognitive skill components of word processing is of major importance. Most of the major word processing packages include multiple ways of achieving the same end. Cognitive skill comes into play during the decision making process of deciding which editing method is most appropriate (fastest or most efficient) to get the job done. It is possible, for example, to backspace along a line of text using the typist's familiar backspace key (which in Word 5 deletes all text) or a similar action can be carried out using the arrow key to move one character at a time back along a line (without deleting text) or one can use the function keys to jump from word to word, or the home and end keys to jump back and forth between the beginning and end of a line. Each of these functions will be most useful or most efficient for different types of editing tasks. The job for the learner is to distinguish when each editing method achieves the desired goal in the most efficient way.

Adults differ from children in how they come to a new learning situation. Perhaps the main distinction is that adults choose what they learn and set their own goals for learning; they do not wait for the teacher to tell them what to learn, how to learn it, and what use it will be to them in the future (Knowles, 1978; 1984). Adults do much of the thinking about these new activities on their own. As stated earlier, for computer learning most adults are not interested in the way the computer system operates but only wish to learn enough so that they can get on with the tasks assigned to them. Computers are seen as a tool, not as an end in themselves (Waern, 1987).

One of the primary activities learners undertake when they come to a new learning situation is to attempt to fit previous experiences and their expectations of the outcomes of this learning into the new learning experience. For people new to computers this is quite a difficult task. There are no previous experiences which match closely using computers; and it is often extremely difficult to imagine what this new thing can do for you (Waern, 1987).

Typewriters are often compared with using word processing packages. They both require new text to be typed in. Information typed in scrolls on the paper (on a typewriter) or scrolls on the screen (on a computer). Making changes to documents on a typewriter is a laborious task of physically rolling the platen to locate the text; erasing it in some way, character by character on self-erasing typewriters or by hand using some chemical solution; finally retyping the text - assuming the number of characters deleted matches the number to be inserted! In Word 5, as in all word processing packages, deletions and insertions are carried out by using editing commands from the keyboard (see Chapter 4, below for a discussion of Word 5 editing functions); new text, when typed in, pushes the rest of a line along so that any amount of text can be inserted at any place in a document. Further changes, such as cut and paste changes, occur with a touch of a few keys, rather than the actual cutting and pasting which can occur with typed documents. Finally, one of the greatest differences between the typewriter and computer is the ability to save text for use at a later time. This allows for additions, deletions, modifications or even merging several documents together without the need to retype text.

So, computers do not fit the experience of using a typewriter very well. Secretaries coming to this learning experience have to adjust both their expectations of what the computer can accomplish for them and adapt all their previous conceptions of typing at the same time.

In the following chapters relevant studies of word processing and theories of learning which underlie them will be reviewed and discussed. The longitudinal naturalistic investigation exploring how 31 University secretaries learn to use a word processing system will be presented and the results discussed.

CHAPTER 1

STUDIES OF USING WORD PROCESSING SYSTEMS

In this chapter studies of both novice and skilled use of text editing and word processing systems will be reviewed. Some studies review different training strategies for learning to use text editors and word processing systems and it will be seen that one of the main conclusions in these studies is that to encourage learning, trainers should provide an active learning setting to match the needs of the adult learners.

The secretaries in the present study were part of a short-term longitudinal investigation and were seen, in their own offices, once a week for 4 weeks. Only one study, to be reviewed here, was carried out in a naturalistic work setting; all the others were in laboratory settings. This may make the findings difficult to generalize to an 'on the job' learning situation such as usually occurs. Another difficulty is that many studies include university students as subjects. These subjects may differ in their motivation to learn and their learning strategies and thus be of limited relevance to the current problem.

Studies of how novice users learn to use text editors will be reviewed first, followed by studies of age differences and general computer experience and their effect on learning. Studies involving skilled users will introduce the GOMS model developed to describe error-free text editing sessions. This model will be described and work presented which supports the model. Finally, relevance of the work presented here will be considered in relation to the secretaries in the present study.

STUDIES OF TEXT EDITING AND WORD PROCESSING

Text editors and word processing systems are the most researched area of human computer interaction (Baecker & Buxton, 1987). Much work has gone into the evaluation of different text-editing systems (Roberts, 1988; Roberts and Moran, 1983). These evaluations have focused on the different aspects of the text editing systems. For example, studies have explored the menu systems and command structures designed by system designers and their acceptance by computer users (cf Borenstein, 1985; Dumais, 1988). Other studies have focused on how users interact with the text editor (cf. Card, English and Burr, 1978). These studies have all explored text editors and word processing systems in terms of system design features and not in terms of the individuals who use them. In other words, these studies have looked at individual differences in users and account for these differences in terms of the design of the system rather than including explorations of differences between user characteristics.

Studies relevant to this investigation can be broken down into two broad areas: studies concerned with novice users learning to use a word processing system and studies with skilled users to explore the limitations of the word processing systems and user characteristics. The terms 'text editor' and 'word processing' actually refer to quite specific types of computer-based systems. Historically text editors were used to input and manipulate text on Mainframe computer systems. These editors, typically, used command systems similar to computer programming languages. They use a command system to make changes line by line and tend to be slow and cumbersome to use when compared with modern word processing packages. Word processing developed alongside the development of personal computers (PCs) and with technological changes are now screen based; they often have menu systems to aid users, while some use a mouse to move around the screen. In studies dating up to about 1985, the terms text editors and word processors seem to be used almost interchangeably, and many studies made comparisons between both types of systems.

Most of the research carried out on text editors has occurred in artificial laboratory settings with subjects participating in experiments designed to examine a particular aspect of text editing. Research programmes at both the IBM Thomas J. Watson Research Laboratories, in New York, and the Xerox Palo Alto Research Center in California have carried out much of the research related to the use of text editors and word processing systems. Both research groups have been involved in this work for many years, trying to discover how best to prepare training materials for use with their own computer based products. This area of research is not limited to these two research establishments, but their influence has been greatly felt.

HOW NOVICE USERS LEARN TO USE TEXT EDITING SYSTEMS

Mack, Lewis and Carroll (1983) and Carroll and Mack (1983; 1984) of IBM, followed 10 temporary office workers in a laboratory setting to see how they learned the skills necessary to use one of two text processing systems. The method of data collection was based on thinking-aloud protocols, as suggested by Ericcson and Simon (1980), Nisbett and Wilson (1977) and Lewis and Mack (1982). In TAP the subject, in this case a temporary secretary, speaks out loud all her thoughts on what she thinks she ought to do and how she thinks she will carry out the action. So the main outcome of TAP as a research method is the reason or justification subjects give for performing actions. (There are several limitations of TAP as a research method which will be discussed in Chapter 4, below.) Giving reasons allows researchers some insight into the thought processes and strategies which subjects use in sorting out how to carry out the computer-based editing tasks.

In the Mack studies, the 10 temporary secretaries were divided into 2 groups of 4 and 6 secretaries. The group of 4 were given self-instruction manuals of a subset of word processing operations to use on a command based system; the group of 6 used a menu based word processing package. The material used involved entering (and correcting where necessary) a document, including formatting and printing. They had to be able to save and retrieve the document and merge it with another. The secretaries were allowed as much time as they wanted (up to 12 hours) before embarking on the practical tasks. Each spoke aloud about what they were doing and what they thought would happen with each action they performed throughout the practical sessions. Verbalizations were recorded and observers were present. Researcher intervention occurred very rarely and only in those instances when it was felt a secretary appeared to be about to give up and leave the task altogether.

Mack, Lewis and Carroll summarize their eight major results with implications for the design of both training materials and software as follows:

1) Learning Is Difficult
Learners experience frustration and blame themselves
Learning takes longer than expected, and learners have trouble applying what they know after training

2) Learners Lack Basic Knowledge
Learners are naive about how computers work (e.g., do not understand computer jargon)
Learners do not know what is relevant to understanding and solving problems

3) Learners Make Ad Hoc Interpretations
Learners try to construct interpretations for what they do or for what happens to them
Learners' interpretations can prevent them from seeing that they have a problem

4) Learners Generalize From What They Know
Learners assume that some aspects of text editors will work like typewriters (especially functions that simply move the typing point on a typewriter)
Learners assume that text-editing operations will work consistently

5) Learners Have Trouble Following Directions
Learners do not always read or follow directions
Learners do not always understand or correctly follow directions even when they do try

6) Learners Interact
Learners have trouble understanding that one problem can create another

7) Interface Features May Not Be Obvious
Learners can be confused by prerequisites and side effects of procedures
Learners can be confused by feedback messages and the outcome of procedures

8) Help Facilities Do Not Always Help
Learners do not always know what to ask for
Help information is not always focused on the learner's specific problem (Mack, Lewis & Carroll, 1983, p. 259)

Clearly, then, the above study indicates that learners have great difficulty unravelling the complexity of the systems being used in order to make sensible use of them. These problems may be due partly to the design features of the specific systems which do not appear to be geared for learners at this most early stage of learning. But some of the problems could be due to individual differences in characteristics of the novice users which affect their performance. What is clear from the present study is that the secretaries could not identify what they did not know and so could not make sense of the help on offer.

Carroll and his associates (Carroll & Mack 1983; 1984; Carroll & Rosson, 1987) examined this piece of research from a slightly different angle, that of how secretaries learn. They suggest that learning to use a computer system requires an active style of learning but for naive users this causes difficulties both with the interface with the computer itself and with the learning of the word processing system, because the activities of an active learner interfere with the learning situation.

> However, what we see in the learning to use a word processor situation is that people are so busy trying things out, thinking things through, and trying to relate what they already know (or believe they know) to what is going on that they often do not notice the small voice of structured guidance crying out to them from behind the manual and system interface. (Carroll & Mack, 1983, 263)

They report further evidence that the secretaries in their study are active learners in the way in which they try to interpret why the computer works the way it does. This form of learning involves integrating the new knowledge into what is already known. In doing this a learner constructs interpretations for understanding how things work. Mack and Carroll suggest that:

> The number of possible interpretations is much greater for new users than from experienced. The former have less relevant knowledge to use in constructing interpretations. (ibid. 264)

This lack of relevant knowledge may account for why novice active learners are unable to take into account the computer's limitations and logical structure. In other words, learners often are unable to devise logical or reasonable goals for themselves in terms of the system they are using. The systems themselves have been designed in ways which do not help new learners.

> The fragility of instruction sequences, coupled with the propensity of learners to try and recover by initiating exploratory forays, can result in problem tangles: Learners who may not fully understand the individual operations, have little basis for appreciating the subtle interdependence of clusters of word processing operations. They may be unable to diagnose or even recognize the problems they encounter. (Carroll & Mack, 1984, 23)

Carroll and Rosson (1987) do not discuss any individuals in their sample who showed a more passive approach to using computers. This is surprising as one would expect some non-active learners to be included in their sample. Such individuals typically wait for instructions on which keystrokes to use, request help frequently and are quite hesitant in making any moves which might be construed as active.

To support active new users of word processing systems the IBM group have developed the "Minimal Manual" for use with the "Training Wheels Word Processor" (Carroll, 1985). This system is geared to new users and the logic, or lack thereof, which they have been seen to use when interacting with computers initially. The goal of the Training Wheels system is to make it impossible for learners to get into as many unrecoverable error states as a full word processing system and hopes to facilitate the transfer of knowledge and skills as they are being learned. An alternative to limiting the editing options available to novice users by design changes might have been to develop a techniques to encourage novice users to recognize when an error has occurred; help them to develop techniques for diagnosing error states and implementing recovery strategies.

To summarize this series of articles then we see that the IBM research group views learners (in this case secretaries) as active users of word processing systems. Because they are new to the task they often misinterpret the goals of the task or to have a conceptual misunderstanding of the processes needed to carry out a task. As active learners they tend to jump in but once "in" often encounter difficulties getting "out". The word processing systems reported here (and never formally identified) do not take this level of user into account in terms of the design of the actual system or the on-line help systems, documentation and instructional material. This would leave the learners in a position of either having to rely on an expert to help them through or to muddle along as best they can and sort things out over time. The Training Wheels system is an attempt to help new users of word processing systems develop some preliminary skills necessary to integrate expectations, computer skills and previous knowledge into a useful system.

AGE DIFFERENCES IN LEARNING TO USE A COMPUTER

Czaja, Hammond, Blascovich and Swede (1986) tried three different training strategies to teach secretaries how to use the word processing package Wordstar 2000. A 3 X 3 design was used. 135 women, all new to word processing but able to type a minimum of 20 wpm, were divided into three age groups: young (25-39) middle (40-54) and old (55-70). They were then randomly selected into one of the three training strategies: instructor-based, manual-based and computer-based. The goal was to assess the training potential of each of the 3 training systems. In the instructor-based situation learners were trained using a lecture method. The lecture followed an edited version of the Wordstar 2000 manual and then subjects carried out a practical task using the material just presented. For the manual-based condition learners received the edited version the Wordstar 2000 manual used above and were asked to work their way through it completing the practical tasks as they came to them. In the computer-based situation learners used a commercially available on-line system called *Teach Yourself Wordstar* (from American Training International). Learners worked through 2 modules and had to answer correctly each question before the program would continue.

Subjects, in groups of 3, attended one training session, which lasted a full eight hours. In this time they completed questionnaires, received 3 hours of training using one of the strategies described above, and were given 5 experimental tasks, lasting 2.25 hours, to measure their word processing ability and performance and post-training attitudes. The attitude questionnaires were on computers, word processing, their own performance and the training strategy. Performance was measured in terms of five tasks, including a short business letter and address list and a revision of a previous draft version. Scores were based on several features of each task such as errors in spelling, formatting and structure; speed, accuracy, overall layouts.

The results indicate the learners using the computer-based system scored significantly lower on most measures of performance than the other 2 training strategies. They attempted and completed fewer tasks; took longer to complete tasks; created more structural errors on the completed tasks. There were no differences in performance between the lecture-based or manual-based learners. In terms of attitudes towards computers there were no differences among the groups on pre-, post- or pre-post measures. However the computer-based group showed a significant difference in attitudes when compared with assessment measures from the other 2 groups.

> the findings indicate that training strategy has an impact on success in learning to use a word processor (1986, p. 213)

For all subjects the computer-based training strategy was least effective as compared to either the lecture or manual strategies. This is not surprising given the type of computer-based strategy used. *Teach Yourself Wordstar* uses a common technique of requiring a correct response before the program moves to the next section. It is not possible for users of such a system to jump around and choose what section to do next, and the "practice" sessions do not allow for exploratory behavior. Therefore, this computer-based training strategy represents a very passive mode of training. What is surprising is that the study found no significant differences between the manual and lecture strategies. However, it is possible that because the practical sessions were identical and allowed the learner to try out or repeat techniques they may have had a similar effect. Both these strategies encourage a more active style of learning similar to that described in the Carroll and Mack studies.

It is important to note that none of the women who participated in this study appears to have gained a conceptual understanding of the word processing package. This means that though these 135 women could use the rudimentary functions of Wordstar 2000 they did not have an understanding of the underlying system.

Additional analyses of the data reported above suggest that the older women had more difficulty using the Wordstar menu system than younger women (Czaja, Hammond, Blaskovich and Swede, 1987; Czaja, 1988); and that the older women had greater difficulties learning to use Wordstar than the other 2 age groups.

Several other studies have also examined possible age differences in learning to use text editing systems. Elias, Elias, Robbins and Gage (1987) compared 3 groups of adults (18-28; 37-48; 55-67) on several measures of text editing performance and general learning capabilities. They found no differences in ability to learn and learning capabilities but when compared on performance of a specific text editor some differences emerged. The oldest group were slowest in performing tasks; and on one task produced significantly more errors than the other 2 groups. The oldest group also requested more assistance than either of the other groups and were more concerned about the possibility of harming the equipment. The authors suggest that in training older computer users, attention to the training strategy is paramount. They recommend that older users be given:

> a clear and fairly extensive explanation of the hardware and software.
> 2) Include a specific lesson on the differences between traditional manuscript preparation (typing) and word processing
> 3) Provide take-home, printed study material for those areas that are especially difficult for the older trainee.
> 4) Keep all training sessions a maximum of 2 hr in length and provide additional sessions if necessary. (Elias, Elias, Robbins & Gage, 1987, p. 347)

The differences between older and younger users may or may not make a long term difference in the use of editing systems. Presumably the fear of harming equipment is one which is encountered for anyone entering a new an alien culture (Sproull, Kiesler and Zubrow, 1987). Older people may have had less opportunity to know about computers and other new forms of technology. With increased interactions, this fear will diminish. Working more slowly may or may not be a detriment. The oldest group in the Elias, et al. (1987) studies were aged between 55 and 67 years old. This group would undoubtedly show large individual differences of performance, motivation, and ability; perhaps more individual differences than within the other age groups studied. One criticism of these studies is the age ranges under investigation. The youngest group consists of business study students who may differ from the other groups in ways not investigated. There are gaps between the age ranges covered so that individuals between the ages of 29 and 36 and between 49 and 54 are not included in the sample. These ages would account for two different, but important, periods of working life, the first group beginning to get on in their careers and the second being at the height of their productive life.

It seems unreasonable to suggest that recommendations put forward should be applied to only one group of computer users. The idea that older users may have training needs which differ from younger users is not in question. However, the delivery of good high quality training which provides material to be taken away and thought about independently from the training sessions would appear to be a good strategy for use with any group of users. It would seem, then, that the training requirements of older learners has not been accounted for in the recommendations put forward by Elias, et al. (1987).

Studies carried out at Bell Laboratories in New Jersey focus on the use of text editors on Mainframe computer systems using the UNIX operating system developed by Bell Laboratories. These studies focus on the limitations of the editing systems and how to improve the human-computer interface and are not focused on characteristics of users which affect their computing performance. Gomez, Egan and Bowers (1986) report on two studies which suggest that older learners have greatest difficulty learning to use command driven text editors. Their studies included 33 women ranging in age from 28 to 62 years who were all new to computers. All were skilled typists. In one exercise the women used a Mainframe UNIX editor called ED (this a precursor to the EX editor still in use on UNIX systems). The women were given printed instructional material for use with an interactive program to learn simple editing commands (append, delete, substitute). Small differences between older users, those with low spatial ability skills and younger users were found. Beside age differences, reading ability and spatial memory accounted for large differences in performance measures.

In a second study of 41 women (age range 26-63), learner characteristics were compared in use with real command names (append, delete, substitute) and fake names (accost, deafen, settle). The group learning the fake names took considerably longer to read the manual. The 'real' group performed better on the memory test but it should be pointed out that use of the commands requires only the initial letter to operate. Overall the results of both studies suggest that reading ability, spatial memory and age are all factors which affect the learning of word processing techniques.

In another study, Gomez, Egan, Wheeler, Sharma and Gruchacz (1983) compared user characteristics with a screen based UNIX editor called TED. In this study of 40 women aged 28 to 62, differences in spatial memory only were found. There was no information provided about the characteristics of these women except to say that were all touch typists. The authors conclude that screen based editors are faster and easier to use than line-based editors, such as ED, described above. They further suggest that these easier screen based systems counter any possible age differences which occurred in earlier systems. Again, the purpose of this study was to explore the interface requirements of the editing system and not to explore systematic differences between users.

EFFECT OF PREVIOUS COMPUTER EXPERIENCE ON LEARNING

Rosson (1985) is one of the few researchers to examine text editing in everyday use. She carried out a survey of 135 employees at the IBM Watson Research Laboratory and then monitored the text editor use of 36 employees (17 secretaries; 11 researchers and 8 programmers). Her results suggest that practice and experience alone do not encourage the use of efficient editing methods:

> The combination of the survey and monitor results indicate that users do not come to exploit an editor's features simply as a function of increased experience with the system. (Rosson, 1985, p. 49)

She found that prior experience with other editing systems and the type of job people held (secretarial, programming, or research) were better determinants of who was more apt to exploit the text editor fully. She argues that designers could make more efficient methods easier to learn; and if designed to be tried out in a fail-safe method, may encourage users to acquire more efficient methods.

Rosson believes that users get what they want and need out of a text editing system and learn more only as and when it is required. In her study the editing requirements of programmers, researchers and secretaries were quite different and each group exploited only those features relevant to their own work. This view is different from some of the more technically oriented researchers (such as Card, et al., 1983) who imply that over time users will exploit more and more of a system. The reasons why a user might do this is never made clear.

OTHER STUDIES

Many other studies, mostly using university students as subjects, have explored issues of how novices learn to use computer systems. Waern and

Rabenius (1986) explored the use of metaphors as a training strategy for 40 psychology undergraduates learning to use a word processing system. They found that metaphors seemed to either help or hinder only for the first encounter with the word processing system; after that users seemed to concentrate on learning the system rather than whatever model they were working from. The results also suggest that these undergraduate women preferred to use a hands-on problem solving approach to the editing tasks, rather than reading the manual to learn how to solve each problem. An interesting point was made that many of these women preferred to delete a character, move the cursor 1 or 2 places and reinsert it, then to retype a short string. This may be a different type of behavior from skilled typists who may choose to delete a short string of text and retype it rather than using the command system to move it. The authors conclude that the strategy which these undergraduates used may be due to university students' expectation which make them prefer problem solving strategies rather than following procedures laid down in a manual.

Mayer (1981), Weiser and Shertz (1983) and Waern (1989) describe differences between novice and expert computer programmers. This they develop to describe the knowledge and strategies required to shift for a novice to expert approach to a programming language. There are differences between computer programmers and secretaries using word processing systems. Programmers, generally are preparing programs to develop their own work. They have a vested interested in the outcome. In addition, they generally have a scientific or engineering background. Secretaries are generally using word processors to create and edit documents of other people's work, not their own. These differences could affect the way novice programmers and novice word processors come to the learning situation.

Sproull, et al. (1987) examined issues of learning to use the computer system at Carnegie Mellon University and their policy that each undergraduate arrives with his or her own computer. One suggestion they make is that naive users should be regarded as entering an alien culture and should be helped into joining the computing culture. Tesch and Hoffman (1988) also discuss the enculturation required of people new to computing in a qualitative analysis of novice computer users. They describe the often unreasonable expectations people bring to a computing situation and the difficulty in demystifying computers to novice users.

Wilson, Barnard and Maclean (1990) studied 8 naive users learning to use an interactive business system (VisiOn) which has word processor, spreadsheet and graphics components. They conclude that the preconceptions (both accurate and inaccurate) which new users bring to computing changes during learning and that new accurate and inaccurate knowledge is developed.

> The most significant change is in fragments that permit recovery from error states which become more accessible when those states are encountered. (Wilson, et al. 1990, 170)

Allwood (1990a; 1990b) carried out studies using TAP (described above) to examine analogical thinking processes in naive computer users. He concludes that the knowledge which new users bring to computing influences the novices' interactions with the computer and the learning and that novices are often not able to use their new knowledge to counter the previous knowledge they arrived with. Schindler and Schuster (1990) examined the type of information new users require to operate text editors. To develop an accurate internal representation of the computer system they are learning, new users need different classes of information including: verbal phrases or labels to represent actions carried out by the system (such as, delete, append, load), codes of key combinations used to perform certain functions, knowledge of physical actions required, task-relevant processes which may not be explicit.

In an interesting article reviewing the evidence for individual differences in human-computer interaction, Egan (1988) summarizes the studies on text editing. He notes the standard deviations and range of response time within each study as evidence for large individual differences among the samples involved. For instance the 33 novice users participating in the Gomez, et al. (1986) study had a range of 1.2 to 6.5 minutes (Execution time per successful change); the 8 skilled users in the Card et al. (1983) studies, reported below, show a range of 19 to 67 seconds per modification. Egan then examines the user characteristics which might account for the large individual differences noted. He suggests that:

> Several factors determine which predictors will account for differences in the performance of people using a specific system.
>
> Almost every setting restricts the range of user differences on one or more dimensions. In some settings well known selection criteria operate. In other settings, selection (including self selection) is more subtle but equally powerful. Designers should know how users are likely to differ from each other in the particular setting for a system. (Egan, 1985: 558)

It seems as though Egan is suggesting that because it is difficult to isolate user characteristics which consistently interact with user performance, then the cause is due to system designs of the particular word processing systems being used in the studies rather than systematic differences in users. There are, of course, going to be some system specific characteristics which will affect user performance (for example, line editors versus screen based editors); however, the studies examined (Gomez, et al., 1986; Egan and Gomez, 1985; Card, et al., 1983; Gould and Alfaro, 1984) attempt to investigate individual differences among a few personal characteristics (e.g., age) only in terms of speed of performance and not in any other way.

STUDIES WITH SKILLED USERS

The studies carried out at the Xerox Palo Alto Research Center focused on both text editors using command systems and more modern PC based word processing systems utilizing both menu and key code systems for modifying text. The Xerox studies have concentrated on experienced users of the systems under study. These experts were employed to examine the limitations of the systems and characteristics of skilled use rather than exploring how people learn to use them. One research programme at Xerox developed a model for error-free text editing; this is described below. Other Xerox research is described here.

In one study of 8 experienced users of the BRAVO editor (used on a Xerox Alto PC), Card, Robert and Keenan (1985) show that with editors such as BRAVO typing speeds match or better the composition of text by hand. This countered an earlier study by Gould (1980) which suggested that composing by hand was faster than composing using a text editor. Card et al. (1983) suggest that it is the changes to the computer system which account for the reversal of times. Early text editors were often quite cumbersome, requiring each line to be inputted using a separate command. This is quite different from the BRAVO system in which any length of text can be typed in without using commands.

THE GOMS MODEL OF TEXT EDITING

Card, Moran and Newell (1980a; 1980b; 1983) developed the GOMS model to describe the error-free behavior of executing specific text editing tasks. The GOMS model "takes into account the cognitive information-processing activities of the user." (p. 139). The model defines a user's cognitive structure as being composed of a set of Goal, Operator, Method and Selection rules used to carry out any editing task.

> for error-free behavior, a GOMS model provides a complete dynamic description of behavior, measured at the level of goals, methods, and operators. (1983: 146)

The underlying principle of the model is the Rationality principle:

> Rationality Principle. A person acts so as to attain his goals through rational action, given the structure of the task and his inputs of information, and bounded by limitations on his knowledge and processing ability:
>
> Goals + Task + Operators + Inputs + Knowledge + Process-limits --> Behavior.
>
> (Card, et al., 1983: 86)

The model assumes, therefore, that text editing (together with the decisions made concerning the selection of methods and procedures) is carried out in a rational way and that the total behavior of a user can be broken down in to information-processing cognitive structures. It seems unlikely that novice users would be able to work in as rational a way as skilled users given their limited knowledge of the system they are using and their lack of experience with text editing systems. It is necessary to discuss the specific components of the model before describing the experiments presented to defend it.

Goals. In any text editing session the overall goal will be to edit correctly the manuscript or document. Several sub-goals will comprise the overall goal; namely to achieve each editing task that is necessary to reach the ultimate goal.

> The dynamic function of a goal is to provide a memory point to which the system can return on failure or error and from which information can be obtained about what is desired, what methods are available, and what has been already tried. (Card et al., 1983: 144)

For example, to prepare this dissertation for submission the overall text editing goal is to produce a top quality document. To achieve this goal involves any number of sub-goals (or unit-tasks as they are called in GOMS) from correcting spelling mistakes, moving sentences within paragraphs, producing tables and figures in the correct locations, and moving paragraphs around.

Operators. Operators are used to achieve each sub-goal. This is perhaps the most difficult component of the model and Card et al. define it in several ways.

> Operators are elementary perceptual, motor, or cognitive acts, whose execution is necessary to change any aspect of the user's mental state or to affect the task environment. (Card et al., 1983: 144)

In other words, operators involve both the perceptual motor skills necessary to locate the problem visually on the screen and to move fingers to press the correct keys and also the cognitive skills required to assess inputs and decide outputs.

> An operator is defined by a specific effect (output) and by a specific duration. The operator may take inputs, and its outputs and duration may be a function of its inputs. (Card, et al., 1983: 144)

One of the basic tenets of the GOMS model is that behavior can be measured in terms of the time taken to select goals, operators, methods and the execution time to carry out the specific editing task. Predictions about time can be associated with each operator.

The underlying psychological mechanisms for operators is described as follows:

> For a specific model, the operators define a grain of analysis. In general, they embody a mixture of psychological mechanisms and learned organized behavior, the mixture depending on the level at which the model is cast. The finer the grain of analysis, the more the operators reflect basic psychological mechanisms . The coarser the grain of analysis, the more the operators reflect the specific of the task environment, such as the terminal, the physical arrangement, and the editor. (Card, et al., 1983: 145)

Methods. Methods are the procedures used to accomplish goals. This would include the knowledge of what sequence of keys or commands must be used to achieve successfully each sub-goal.

> The description of a method is cast in a GOMS model as a conditional sequence of goals and operators with conditional tests on the contents of the user's immediate memory and on the state of the task environment. (Card, et al., 1983: 145)

Methods are previously learned procedures and therefore, according to the model:

> the methods are sure of success, up to the possibility of having been mis-selected, the occurrence of errors of implementations, and the reliability of the equipment. (Card, et al., 1983: 145)

Therefore assuming the correct method was selected and executed correctly without the equipment failing in some way then success is guaranteed!

Selection. The last portion of the model is selection. This is the process of how a user chooses among the methods available. Selection represents the decision making process of choosing which method or procedure best fits the task at hand.

> When a goal is attempted, there may be more than one method available to the user to accomplish the goal. The selection of which method to be used need not be an extended decision process, for it may be that task environment features dictate that only one method is appropriate. On the other hand, a genuine decision may be required. The essence of skilled behavior is that these selections are not problematical, that they proceed smoothly and quickly, without the eruption of puzzlement and search that characterizes problem-solving behavior. (Card, et al., 1983: 146)

GOMS is a model of skilled performance; as such, it does not address the issue of how users become skilled users. The model assumes that all skilled users will make errors but that these are dealt with in a routine way because "What is true of skilled behavior is that the detection and correction of errors is mostly routine." (146). Therefore, Card, et al. suggest that "errors are quickly detected and result in additional time to correct the error." (147) These errors or times to execute tasks are the individual differences (or variance) between users.

As a model GOMS attempts to explain the cognitive mechanisms by which skilled users of a text editing system operate that system. The model makes several assumptions about the users. First, the model is only for skilled users; it makes no attempt to account for how users become skilled, or for the cognitive processes which underlie unskilled use of a text editing system. Second, an implicit assumption to GOMS is that users will select methods which take the least amount of time. In other words skill is equated with speed and the more skilled the user the quicker she will be. Other definitions of skill or efficiency are not addressed in the model, as presented. For example, it is possible that some users followed a model of efficient use to be the least number of keys pressed to carry out an editing task. As noted above, skilled users do not necessarily have knowledge or use advanced editing techniques, but rather stick to what they know and feel comfortable with. This may be incompatible with the fastest solution. Third, GOMS is concerned with error-free behavior. Though it is assumed that all users will make errors, the effect of those errors is seen only in terms of an increase in time to complete a given task. For skilled users, Card et al.'s implication is that they will be able to recover from any error situation with the quickest solution. For novice users this is certainly not the case (cf. Carroll and Mack, 1983; 1984). Many novices not only have difficulty detecting errors or difficulties but then compound the problem by using inappropriate methods to try to correct them. There is also no mention of the unlearning which new computer users often must undertake in order to acquire methods of "good practice" in word processing. For example, typists often have to unlearn the procedure of pressing the enter key at the end of a line as word processing systems do this automatically and instead press the enter key only at the end of a paragraph. Finally, Card, et al. (1983) give no indication of the limits to the skill users gain. They suggest that with more practice the better (i.e., faster) users will become. One assumes that there will be a levelling off of skill, but either the subjects had not reached this level or it is not accounted for in the present theory. If the former, one must wonder how experienced their 'experienced' users really were.

The cognitive processes of GOMS, utilized during editing sessions, were developed by Moran and Card (1982) and can be accounted for within Anderson's ACT* (1983) model of knowledge representation systems (discussed below).

To test the validity of the model, Card et al. (1983) report a series of experiments to observe patterns of behavior which they hypothesize reflect the underlying cognitive structures. Some of these studies pre-date the development of the GOMS model (Card, et al., 1978; Card, et al, 1980a; 1980b); other studies were designed to test GOMS.

As indicated above, many of the studies used to test GOMS used time as an indicator of performance. These text editing studies were carried out before the advent of word processing packages and so used more limited command driven text editors.

STUDIES IN SUPPORT OF GOMS

One study compared the performance of different skilled computer users. Differences between what Card et al. (1983) referred to as dedicated versus casual users showed a difference in the amount of practice time. There were also some differences between technical versus non-technical users and fast versus slow typists. Eight subjects made 66 corrections in a 22 page memo. The corrections varied in terms of complexity and type. The subjects received scores on length of time to complete the editings without errors. The results show that dedicated users were faster than casual users; technical users faster than non-technical users; and fast-typists quicker than slow-typists. It is not possible to make statistical comparisons between groups with a total of only 8 subjects.

Another study explored when it is faster to retype a passage of text or use commands to move text around. The results are based solely on the length of time involved in performing the 2 alternatives. Fast typists will retype longer passages than slow typists.

One experiment examined how skilled users select editing methods and whether these can be predicted. There were only 3 subjects in this experiment (2 secretaries and 1 computer scientist); all were experienced users of the POET text-editor. Subjects were asked to edit an 11 page document requiring 73 modifications. They worked from a printed copy with the modifications marked in red. Different forms of editing were required, including deletions, insertions, changes or replacements of text. All subjects' key strokes were recorded and stored within the computer for analysis later. The results suggest that each user has a dominant editing method and that this can be predicted from the GOMS model. The method selected to carry out an editing task is heavily dependent on the task environment. Clearly, skilled users select methods on the basis of where the cursor is in the text in relation to the desired location and the type of modification required. Terminal speed was a predictor of which location method was selected. On fast terminals a line by line approach was often used; on slow terminals line by line was used only when the desired cursor shift was only 2-3 lines away from the present position. These results suggest that there are large individual differences in how skilled users of POET select methods and carry out editing tasks; further, that in spite of the individual differences, users are systematic in the methods they tend to use.

GOMS SUMMARY

GOMS is a descriptive model of skilled word processing use. It is useful in the present investigation because it suggests where novice learners hope to get to. The model shows how skilled users select methods and procedures with apparent ease; and take errors or problems in their stride. The model provides some information towards understanding how users go about deciding which method to use.

CHAPTER SUMMARY

The studies of word processing use carried out by Carroll and his colleagues suggest that adult learners use an active style of learning. This both hinders and helps the learning of word processing systems for two reasons. First, the hindrance is that new users often lack the knowledge to interpret and correct error situations. They may make assumptions about the system which do not tally with reality. Second, the positive helpful side of active learners is they tend to explore and exploit new learning situations and this allows them to discover methods on their own which should lead them to a better, more thorough, understanding of the system. Other researchers have remarked on the phenomenon of active users; no other research seems to have been able to confirm other types of user strategy.

It was seen that some age differences were found between different groups of novice users. These differences were not connected to the learning ability of different age groups, but rather on the speed and accuracy of different ages to remember and recall information relevant to the word processing system. On-screen menu systems might resolve some of these difficulties for older learners. Secretaries in the present study range in age from 18 to 60 and it will be possible to explore further, possible age differences in performance. One aspect, not covered by previous studies, has been the role of general secretarial experience on learning. Experienced secretaries may have different expectations about a word processing system, especially those who have worked with several different types of manuscript production systems (eg., manual typewriters, electronic typewriters with memories). Previous interactions with computers seem to make learning a new word processing system easier. This may be because the users can generalize concepts from one system to another. Many of the secretaries in this study have extensive previous computer experience both with other word processing systems and with other application packages. There are also several secretaries with no previous computer experience. Therefore, it will be possible to explore the relationship between previous experience and learning to use Word 5.

The studies on word processing do show evidence for large individual differences between subjects and between studies. However, there has been a lack of research investigating the nature of the individual differences noted. This may be because so much research on word processing systems has focused on issues of system design and user interface rather than how user characteristics may affect user performance.

The review of the GOMS model reveals that it may be a useful model of skilled users but it may not be transferable to novice users. One goal of the present investigation is to see how suitable the GOMS model is for describing the text editing behavior of novice users.

CHAPTER 2

LEARNING THEORIES

In this chapter theories of learning relevant to secretaries learning to use a word processing system will be described. It will be seen that many of the studies discussed in the previous chapter draw on these learning theories to provide an underlying cognitive framework. The importance of early associative learning theories and their relationship to modern theories will be highlighted. It will be seen that Anderson's (1983) ACT* system of procedural learning appears able to account for the type of cognitive skill learning involved with learning to use a word processing system.

LEARNING THEORIES

Research on learning has a long illustrious past. The field has changed dramatically from the days of classical and operant conditioning when learning was viewed as the building up of stimulus-response patterns.

It will be argued here, however, that learning to use Word 5 is best described by an information processing model of learning and in particular the use of perception-based and meaning-based knowledge representations as a means of explaining how the secretaries in this study learn this new cognitive skill.

MODELS FOR ACQUIRING SKILLS

Underlying the learning of word processing skills are the psychological theories of skill acquisition. Skill acquisition has always been a popular area for research though the focus of skill has changed over the years. Initially, skill was viewed only in a perceptual motor skill mode; only fairly recently has the notion of skill has broadened to include what are now called cognitive skills, though theorists always included a cognitive component in motor skill acquisition. The notion of skill takes many different forms, depending on the type of skill under discussion. In physical skill an expert shows a controlled coordinated fluidity of motion (Welford, 1968); in cognitive skill the 'skill' takes a different form because so much activity is not composed of motion but in something we shall, for the moment, call thinking. In other words to perform a cognitive skill the action motion accounts for only a small proportion of the total behavior. The rest of the behavior is taken up with identifying the goal and selecting the procedure. Card, Moran & Newell (1983) suggest that up to 60% of time is taken up with this goal identification and selection process for experts carrying out text editing activities, with 40% of the time used in carrying out the physical motions required. For cognitive skill, then, we might think of skill as encompassing both the fluidity of identifying goals and decision making in terms of the cognitive component; and fluidity of motion for the motor side of the behavior. Many models have been proposed to explain how we acquire skills; only a few of the most pertinent to the learning of word processing skills will be discussed here. All these models come from an information processing approach to learning. Information processing systems grew out of earlier theories of learning based on associative psychology. The advent of computer technology gave much impetus to this work and recent advances include complex computer models which simulate various aspects of human behavior.

To understand the information processing models it is appropriate to review, briefly, the basic processes and models central to all current skill theories. (For a fuller discussion of information processing theories and models see, for example, Lindsey and Norman, 1977; Anderson, 1985.)

Fitts (1964; Fitts and Posner, 1968) proposed a 3 phase model for skill acquisition which goes from a cognitive phase through an associative phase to a final automated phase. Fitts describes skill attainment as the creation of new patterns of behavior being formed out of already existing bits of behavior. The new connections combine elements of perception, cognitive processing and motor skill responses. He says:

> the relevant issue for understanding of skill is the nature of spatial-temporal organization of receptor-effector-feedback processing, which often are relatively independent of the specific receptor or effector elements initially involved. (Fitts, 1964, 244)

In the first phase the learner must come to understand the task and its demands. During the second phase previous experiences are associated in new ways. It is also at this stage that corrections or modifications of performance are made. In the final phase the skill becomes automated. Each of the 3 phases involves several activities. The early cognitive phase includes attention to perceptual cues; shaping or modeling behavior by watching an expert or instructor carry out the task. The associative phase is a period of both trial and error (in the sense that old procedures are tried and if unusable discarded) and consolidation where techniques are slowly built up into a final working product. During the final phase, the automatic phase, the skill is performed with less and less attention as proficiency improves.

Welford (1968) also proposes a model to explain skill acquisition. His model attempts to describe, in much detail, the sensory loads on memory and these are reflected in his 6 stages of skill acquisition. In order to perform a task the individual must first comprehend what is required of him or her. Welford phrases this as, "The material to be learnt must be perceived and comprehended and any responding actions selected" (Welford, 1968, p. 287). This he expands, saying that many attempts to learn fail because the learner does not have a clear idea of the goal of learning and therefore cannot place the necessary actions into a semblance of an order. In other words, to learn, the learner must know what it is to be learned so that the links within a process are related to the perceived goal. Stages 2 - 4 involve transferring knowledge into first a short term memory store and then into a long term memory store and finally to be able to recall the necessary information from long term memory into a working memory. Welford's fifth stage is similar to the associative phase described by Fitts where behavior is both reinforced through use and modified where necessary. The final stage is almost a knowledge phase where the learner can access the correct information to perform a specific behavior at an appropriate time.

Anderson's (1976; 1983) model of skill acquisition, based on his ACT and ACT* model of knowledge representation systems, closely resembles the initial phase of both the Fitts' and Welford models, described above. (A Discussion of ACT and ACT* are described in more detail below.) Anderson's first stage is an interpretative one in which a skill is perceived in a series of declarative phrases. This verbal component allows the learner to think through the skill using verbal mediation to guide behavior.

Anderson calls the second stage 'knowledge compilation,' when declarative phrases are transformed into action. This takes place, Anderson proposes, because the use of verbal routines to guide behavior are slow and prone to working memory limitations which may cause errors. The compilation occurs when the verbal mediation of behavior drops out and the behavior occurs without a noticeable guiding verbal component.

The third stage is one of fine tuning the productions, not just in terms of speed and accuracy in carrying out behaviors but also in the speed and accuracy with which choices in performance can be selected and carried out. This fine tuning in seen in all experts of a skill who continually modify their performance in light of all that is occurring around them.

An example comes from top level athletes and a statement made concerning Linford Christie's running of the 100 metres. One comment, attributed to his coach, was that if Christie needed 10.0 seconds to win than he would run that; if he needed 9.87 then he would run that; he would run just what he needed to win. To accomplish this remarkable feat, Christie is modifying his performance on the basis of the other runners in the field and the demands of a particular heat. There is no one way to run 100 metres and win a race; nor is there only one way to carry out any task and achieve the desired end result. An expert or skilled user will take into account environmental cues, internal signals, whatever and modify his or her behavior accordingly.

Using a word processing package is a skilled behavior requiring the fine tuning of motor movements to press the correct keys in the correct sequence. It also involves the fine tuning required to select one procedure out of a vast array for use in a particular situation, in the same way that Christie and other experts modify their performance in order to produce the best result.

The initial stage in the theories discussed above involves the learner in first identifying the task and associated goal. How this occurs was beyond the scope of these skill learning theories. Others have described possible mechanisms for the process of task and goal identification. Some of the proposed models which appear to have most relevance to the learning of word processing skills are discussed below.

Fitts suggested that modeling or shaping behavior could account for the occurrence of task identification. Bandura (1986) expanded on this idea and developed a whole theory of motor skill, or in his terms, enactive learning, based on observational techniques. He suggests that this is a way in which people

> construct conceptions of behavior from observing the effects of their actions during enactive learning (Salmoni, 1989, 204)

Conception induction, a term coined by Bandura, refers to how an observer conceptualizes how a set of separate acts of behavior must be organized to produce a new behavior pattern. Another proposed method for learners to identify the task and goals is through the use of internal mental representations.

MENTAL MODELS AS AN AID TO LEARNING?

One method suggested to aid learners in grasping new concepts or unfamiliar pieces of equipment involves the use of mental models (Kieras and Bovair, 1984). According to Kieras and Bovair, a mental model is a way of understanding how a device works in terms of its internal structure and process. The field of mental models developed from research, in psychology and artificial intelligence, into the understanding of human knowledge about the world (cf. Gentner and Stevens, 1983; Johnson-Laird, 1983).

The term mental model describes a concept attached to a naturally occurring process. Humans try to make sense of the world by interpreting their interactions with elements in the world. The understanding we have of how things work is what researchers call our mental models. Norman (1983) suggests that mental models do not necessarily have to be accurate but they must be functional. Mental models develop or evolve naturally and are modified through further interactions with the system. Norman further suggests that mental models are incomplete; that most mental models would not work appropriately if run in the real world; details may be forgotten; there is overlap between the mental models of several systems so that they get confused; finally that people like to add in extra steps, often repetitive, to be sure a model will work.

MENTAL MODELS

Most studies on mental models have been applied studies using simple domain devices. The goal of research has been to understand how people interpret the inner workings of a piece of equipment. For example Hayes (1979, reported in Gentner & Stevens, 1983) investigated individuals' concepts in understanding the behavior of liquids. To understand the concepts involved in understanding the flow of electricity, Kieras and Bovair (1984) set up experiments using a simple circuit board for use on the Starship Enterprise. Norman's (1983) experiments involved simple arithmetic operations on calculators. It is believed that understanding what individuals know about how something works will influence their conceptual internalization of the device. This internalization will in turn affect their interaction with the device and help or hinder the learning of how the device works.

If an individual's mental model of a device is accurate it is assumed that the individual will be better able to anticipate accurately relationships that occur with the device. Further, the more complete (and accurate) an individual's mental model is, the better able that individual will be in his dealings with that device. The opposite side must also be true. The less complete or accurate a mental model, the poorer will be an individual's interaction with the device.

Thus far, this discussion of mental models has focused on research involving very simplified technical domains. This is because

> those domains that have proved the most tractable to physical scientists are the ones for which there exists the best explicit normative models. (Stevens and Gentner, 1983; 2)

There are clear implications for the need for accurate and complete mental models in some industrial settings. Employees with responsibility for sensitive equipment could help or hinder crisis situations depending on the level of their mental models. Stevens and Gentner note "[Hayes' (1979)] work on liquids would be relevant to understanding why operators of nuclear plants do not always correctly interpret their instruments." (1983; 1).

Physical scientists use equipment where the process can be readily defined and so the connection between this process and the interpretation of the process by the individual is more accessible. We use mental models in all our dealings with equipment and so we all have some sort of internal conceptual understanding of how things work. Using a word processing system is not the same as using the equipment studied so far because the work carried out on the word processor is user driven and task specific. This makes research into the mental models of secretaries' using word processing systems extremely difficult.

DIFFERENT TYPES OF MENTAL MODELS

A distinction must however be made between users of equipment who are providing a service, such as nuclear power workers, and users who require an end product. Clearly, the mental model of the distribution of nuclear energy for the electricity industry is different for nuclear power employees than for the users of electricity. End users do not need a complete or accurate mental model of a system to use it accurately or completely. The flow of electricity is one example; the telephone is another. Few people can describe accurately and in detail the internal working mechanism of electrical power supplies and circuitry or the workings in of the telephone system, yet it is almost universally used. The mental model of telephone users involves representations of picking up the receiver, dialling a number, listening to the different rings and speaking. Clearly, users may have different internal conceptualizations of a device from the creators or developers of the device. Computer systems designers have quite a different model of the computer as a device than the end users of an application package. The systems analysts devising Word 5 have a different mental model from both the computer analysts and the end users of Word 5. Secretaries and other word processing users do not need to have a complete and accurate model of the inner workings of the package or the computer to use Word 5 knowledgeably and efficiently. What they do need is to have a conceptualization of what the word processing system can do so that they will begin to appreciate both its power and its limitations for the work they will carry out.

Norman (1983) raises the question of whether end users benefit from more complete and accurate mental models of some devices when learning to operate the device more quickly or efficiently? This type of question is being explored by both psychologists and technologists. The two groups appear to have come up with conflicting opinions. The technologists suggest that using a piece of equipment is totally unrelated to the design and manufacture of the inner workings of that equipment, so users do not benefit from knowing how a device works. Psychologists, however, believe that knowing and understanding the inner workings of a device does aid users in learning how to operate equipment (Norman, 1983; Kieras and Bovair, 1984).

EVIDENCE FOR MENTAL MODELS OF COMPUTER USERS

Shackel (1990) outlined the different characteristics of computer users over the last 30 years. The research computers of the 1950s required sophisticated systems analysts and programmers to operate the computers. They had a great deal of understanding of the inner workings of the computer. In the 1960s the use of Mainframe computer systems was developed and marketed for businesses. However, most computer users still needed to be very familiar with the workings of the computer in order to operate the software. The 1970s saw the introduction of minicomputers which still required users to be familiar with programming languages and a sophisticated knowledge of interface applications. It has been since the introduction of the microcomputers and application software packages (such as word processing packages) that computer users no longer need to have programming skills or be system analysts. This change in computer hardware and related internal processing mechanisms has created a computer which can be used by the novice (Shackel, 1990).

Nowadays many computer users have concentrated their learning activities on mastering the application packages they use rather than on how computers work. Users take courses on how to use word processing, spreadsheet and database packages and even the principles of desk top publishing, all without learning how a co-processor works or the relationship between a hard disk and the operating system. Would it be useful for these people to have a complete and accurate mental model of how computers operate, so as to make better use of their application packages? Should computer users have mental models similar to the system analysts who designed the programs or the computer engineers who created the hardware?

Waern has worked extensively in the area of the psychological impact of user-computer interactions. In one article she examines the kinds of mental models which aid computer use and argues that several mental models are required to gain a satisfactory level of conceptualization so as to make the best use of computer technology (Waern, 1987). A mental model, according to Waern, has two main characteristics:

> 1) it represents some part of reality and 2) it is to some extent similar to that part of reality. (Waern, 1987, p. 275)

The mental model required to use a computer system involves first defining the goals of the activity and the actions required to achieve that goal. Each individual will have a different conceptualization of the goals and the way to achieve them and so each individual will have a different mental model of the computer system. In order to develop an accurate and functional mental model Waern suggests the user needs several entwined mental models:

> A user of a computer system needs a mental model for planning, problem solving, communicating ideas and stimulating creative thinking. (Waern, 1987, p 275)

The development of an accurate and functional mental model of a computer system takes into account the types of learners involved and their previous experiences while creating an environment where the computer system builds off of previous experience. In this way users create their own internal representations of the system.

> a computer system can facilitate learning by mental models in three different ways: 1) by presenting a model which is an analogue to some prior task, 2) by creating a consistent model for new concepts, and 3) by facilitating the learners' exploratory creation of own models. (Waern, 1987, 275)

One study of the use of mental models in the acquisition of word processing skills was carried out by Frese, et al. (1988). They compared 3 mental model training programs for learning to use the word processing package Wordstar. Wordstar is one of the earliest PC-based word processing packages and uses an onscreen menu to aid the user. Editing functions are carried out using a two keystroke action (e.g., CTRL KD saves text). 15 university students were randomly placed in one of 3 groups. All students were complete computer novices. The first group (sequential learners) received documentation containing a keystroke by keystroke method with no explanations for why keys were pressed in certain orders. The second group (hierarchical learners) received a full manual with all keystrokes described in detail as well as a hierarchical diagram of what to learn and in what order. The final group (Hypotheses learners) received no written information about how to use the system but were encouraged to develop hypotheses to correct a piece of error-riden text. This was the active learning situation.

All groups received equal amounts of training time in using Wordstar and were then tested on measures of command recall, errors, inefficiency, learning transfer, satisfaction and learning style. Experimenters rated each individual on overall performance and typing abilities. The results support the idea that active learners develop a more sophisticated mental model than passive learners and the active users derive greater satisfaction. The authors suggest that the early development of working hypotheses, by the 3rd group, helps dispel misconceptions of the computer system early on, leading to a more realistic view of the system over time.

An exception to the studies suggesting the usefulness of mental models comes from a study by Waern and Rabenius (1986; discussed above). In an attempt to explore the mental models or different metaphorical constructions of novice word processing users she found they either helped or hindered only for the first interaction with the system. Once a user had begun to interact with the system, use of the model diminished.

There must be a middle ground between knowing nothing of the inner workings of a computer and knowing so much as to encompass a change in career! Many application packages available today are extremely sophisticated. Most are menu driven so that the package anticipates many of the needs of the user. This sophistication may lead some users to believe the computer has special magical powers, or that the computer knows best, or that if an option is not on the menu it is not possible. The mental model of these users may involve more elements of computer control and power than is usually associated to them. On the other hand, by providing the most usual options the computer is freeing users from thinking about the computer's needs and so they can concentrate on the task at hand. The technologist views his task as making the computer as invisible as possible in order to be as simple to use as other office equipment. The psychologist views his task as making the working of the computer as visible to users as possible so as to help their learning and understanding about the equipment they use. The two roles are in conflict and will undoubtedly remain so until further research has resolved the dilemma of whether users of sophisticated devices require accurate and detailed mental models in order to facilitate their learning to use those devices.

A mental model of how information is typed from a keyboard, processed in the computer and then appears on the screen could be a more useful image than one which perceives the screen to be directly connected to the keyboard. In the latter example the computer is perceived as being similar to a typewriter so that all information on the screen originated from the typist. Mental models based on this image could cause difficulties because the computer is not perceived to exist in the same way. Problems or queries from the computer to the user may not be perceived or if perceived may not be interpreted in an appropriate or useful way.

Computer users often complain that they do not understand what the computer is telling them. Here a mental model which views the computer as a machine being controlled by a human might be more appropriate than a model which imagines a human being driven by the computer.

MENTAL MODELS: A SUMMARY

Several things have emerged from the foregoing discussion on mental models. We all have mental models for the equipment, devices, systems which we use. These models change and develop over time on the basis of our interactions with that system. A need for complete and accurate mental models was suggested as a way of anticipating and correctly interpreting difficulties within a system. Research has so far been unable to reach a consensus on whether having more complete and/or more accurate mental models of a system helps the user learn how to use that system. Carroll and Olson (1988) suggest several areas of research on mental models in human-computer interaction which need to be carried out. These include, among others, to:

> investigate whether people have and use mental models of various kinds; determine the behaviors that would demonstrate the model's form and the operations used on it; explore how knowledge about systems is acquired; determine how individual differences have an impact on learning of and performance on systems. (Carroll and Olson, 1988: 59, 60)

Such research, as suggested above, is beyond the scope of this investigation of how secretaries learn to use a word processing system. The discussion however, suggests that mental models may be a useful concept in analyzing some of the problems new computer users encounter during the initial learning phase.

SCRIPT THEORIES

Another possible way in which users might identify tasks and goals comes from script theory. Anderson (1983) has attempted to combine aspects of script theory to account for this activity. Scripts are memories for routine everyday events. Formal script theory developed through the 1970s (Schank and Abelson, 1977) and have been explored in young children (Gruendel, 1980; Nelson and Gruendel, 1981; Nelson, 1985). But the idea of scripts or schemas goes back to the work of Bartlett attempting to describe how people remember (Bartlett, 1932)

Bartlett was one of the first users of the term schema to describe "an active organization of past reactions, or of past experiences, which must always be supposed to be operating in any well-adapted organic response " (Bartlett, 1932, p 201). He goes on to say:

> That is, whenever there is any order or regularity of behaviour, a particular response is possible only because it is related to other similar responses which have been serially organized, yet which operate, not simply as individual members coming one after another, but as a unitary mass.
>
> All incoming impulses of a certain kind, or mode, go together to build up an active, organized setting: visual, auditory, various types of cutaneous impulses and the like, at a relatively low level; all the experiences connected by a common interest: (Bartlett, 1932, p 201)

To summarize: learning, according to Bartlett, is based on building from past experiences to incorporate the new learning into a previously held body of knowledge about the world and the way we function in it. He also asserts that learning encompasses all the senses regardless of the specific learning task taking place. This position is similar to Schank and Abelson (1977) who believe that the scripts we hold are continually modified and updated on the basis of new experiences; however, the basic script remains intact and these modifications are viewed as optional characteristics. Using this model, then, our secretaries will be learning to use computers by basing this experience on whatever previous experiences they have and they will incorporate this new skill into the body of knowledge they have. They will probably begin from a typing script and their secretarial script to form a new script for word processing. This script will develop by the incorporation of previous scripts and knowledge as well as input from all sensory organs. However, in order for them to make the shift from viewing word processing as typing there must be a mechanism for concepts unrelated to typing but central to word processing which has to be incorporated.

Research on the development and use of Schank and Abelson's script theory has been limited. Most of the research on scripts has been in the area of early preschool children (cf. Gruendel, 1980) and computer modeling (cf. Schank and Abelson, 1977). The quantity of literature currently available of studies of mental models suggests that script theory is not seen to be as useful a model as mental models in accounting for the internal representations of activities.

The development of script theory and mental models benefited from a paper by Tolman (1948; reprinted 1951) on "Cognitive maps in rats and men". This paper disputed the widely held claims of the time that rats learn to follow different maze patterns solely on the basis of operant conditioning patterns. In other words, rats learn the maze to get to the food at the end and do not learn or take notice of other features of their maze environment. Tolman described several interesting studies of latent learning and vicarious trial and error learning, in which rats were not supplied with the usual stimulating food to encourage movement through a maze, but rather were allowed to wander around in the maze. When food was placed the rats made a beeline for it; indicating, according to Tolman:

> that in the course of learning something like a field map of the environment gets established in the rat's brain. (1951, p. 244).

Tolman hypothesized that as a rat goes through a maze it is learning about the maze and the various routes through it. This knowledge is built up and extended through different trials. It builds on the principles of associative learning and in particular Guthrie's theory of contiguity (1935). Contiguity theory attempted to explain stimulus response patterns using non-operant conditioning principles. Guthrie suggests that material is learned through a single trial. There will be differences in each subsequent trial from the original - in either major or very subtle ways - and these successive trials build up a body of knowledge of when or how to deal with a stimulus.

Another relevant example of cognitive mapping in animal learning comes from the work of Menzel (1978). In extensive work with chimpanzees kept in field enclosures of up to one acre in area, Menzel studied the exploratory searching behavior of groups of chimps. His studies suggest that chimpanzees use quite complicated techniques of covering space in order to locate food and other treasured objects and how to do this by not drawing other chimps to the same area. Menzel suggests that these primates have an internalized map of the area which determines the type of searching behavior to use in a particular situation.

It could be theorized from this discussion that secretaries learning to use a word processing system could begin with a model or script of word processing being like typing and then with each encounter with the new system build up and modify a new model. In this way it can be seen that mental models and scripts rely on the principles of associative psychology to explain the formation and change in models and scripts.

ANDERSON'S KNOWLEDGE REPRESENTATION SYSTEM

The ACT theory (Adaptive Control of Thought) was developed by John Anderson (1976). Since then it has been modified and extended on the basis of further work into the ACT* system (Anderson, 1983). It is the ACT* system which will be described here. ACT* describes:

> the higher-level cognition [which] constitutes a unitary human system. A central issue in higher-level cognition is control - what gives thought its direction, and what controls the transition from thought to thought. (Anderson, 1983, ix)

Anderson's ACT* knowledge representation system is an integrated theory of learning composed of a series of IF THEN statements which allow an individual to set up goals and productions as a way of solving problems, carrying out tasks, formulating facts, etc.

Anderson's basic premise is that all cognitive activity has an initial declarative component and it is this declarative component which defines the task and prepares the individual for action. Anderson expands the initial declarative phase to include 2 separate modes of operation. The first is in the case of extremely skilled behavior when a user, faced with a known task, will plug into a 'recipe' solution. In other words, the user will use a series of actions which are automatic for the given situation. The second mode of operation is when a user is faced with a task that requires something different from the automatic 'recipe'. In this situation there will be a period of working out different possible solutions and choosing amongst them. In other words, this mode typifies problem solving behavior.

For the secretaries in this study a possible initial declarative component might be that they are expected to listen to the researcher who will tell them what change to make to the document and then they will make that change.

According to the model, a secretary will continue to work out the production stages involved for each request.

For example, a secretary might be asked to insert a title at the top of the document. She will then work out that in order to do this she must first move the cursor from its present location to the top of the document. The method she uses to move the cursor will depend on where the cursor is in relation to the top of the document.

Once at the top the next thing to do is to insert the title with formatting that will bold and center it as well as inputting a blank line underneath it. She can accomplish these tasks in several ways, one at a time or in some combination. The methods she uses will depend on her knowledge and confidence in using different formatting techniques.

Secretaries in the early stages of learning to use a word processing system will not have automatic 'recipes' to plug into specific situations. The initial declarative phase will be a period of problem solving. How well a secretary is able to solve the problem will depend on her ability to integrate her, perhaps limited knowledge of the word processing system and how it works, with her ability to press the correct keys in the correct sequence. In the example described above, our secretary will have first to choose which location method to employ to reach the top of the document. She must then actually move the cursor to the top. There will then be another period of problem solving as she decides how best to insert the title, with formatting. This second task will then be carried out.

For the secretaries in this study, then, the declarative phase is both a period of working out the demands of the task and also choosing which method to employ. This will be an arduous task, depending on the level of knowledge and ability to integrate problem solving with action. Anderson gives a caution about the process by which users create new forms of behavior. He states:

> Although new productions must be created at some time, forming them is potentially dangerous. Because productions have direct control over behavior, there is an ever-present danger that a new production may wreck great havoc in a system. (Anderson, 1983, 231)

In other words, while learning to use a word processing system, erroneous decisions can be made which will cause errors, or the actions taken may be done so incorrectly which can cause errors. In either, or both, situations the user may face great difficulties in repairing the specific situation. More importantly, the user may have internalized the fault and so be apt to repeat it in the future unless this connection is also repaired.

In accordance with modern thinking, the ACT* model theorizes that 3 memory stores are used for procedural functions (cf. Loftus and Loftus, 1976; Lindsey and Norman, 1977; Cohen, Eysenck and LeVoi, 1986). Long-term memory (LTM) is a permanent store of all material. LTM is divided into declarative, episodic and procedural knowledge. The short term memory (STM) store is where initial sensory perceptions arrive to the system. These impulses are evaluated and either discarded or passed to the third memory a working memory. Working memory is theorized to be an area in which information from LTM and STM is combined and from which actions evolve.

During the initial learning phases the actions produced tend to be slow and inefficient. Anderson suggests this is because of limitations in how material is passed from one memory store to another and the difficulty a new user has in evaluating incoming material and associating relevant information held in the memory stores. During the second stage of learning, associations are built up, or compiled, into meaningful units which can then be accessed by the user more and more quickly. This leads to a faster and smoother process of evaluating, processing, and executing a task. In the ACT* theory this process of compilation is composed of 2 separate components. The first is called composition and is the process by which several productions are combined into a meaningful sequence. In this way the composition can be recalled from memory and a series of productions then follows. Composition, then, is similar to Miller's description of chunking which is when small bits of information are stored as a group which makes for easier recall (Miller, 1956). This would account for a faster response and execution. The second component is that of proceduralization which is the process by which productions lose their declarative component and operate independently. In other words the productions no longer require a declarative process to be activated. They are triggered directly from working memory. The best example of this is in the use of well known telephone numbers (Anderson, 1976), which often can only be remembered through the action of dialling, rather than trying to recall the number, verbally.

For the secretaries in this study we will see that over time they acquire sequences of actions which can be thought of as embodying this second stage of skill acquisition and the rules of composition and proceduralization which Anderson proposes.

The fine tuning of behavior, which embodies the final stage of skill acquisition noted above, is carried out in 3 ways: generalization; discrimination; and strengthening. The process of generalization occurs when either productions which are identical are replaced with a general over-riding production to encompass both conditions; or by replacing a constant function within a series of productions with a variable condition. In both situations a user fine tunes behavior on the basis of similarities between conditions. A secretary, for example, might notice that 2 or more editing tasks involve an identical move. In this situation she would produce an internalized rule production which incorporates this identical rule into a new form of behavior. The result will be a faster performance and a generalizing of the technique across situations.

Discrimination is necessary in order to restrict the possible range of applications of a production. In other words secretaries must be able to distinguish when a particular production is useful in a specific situation and when an alternative production might be more useful. Anderson hypotheses that 2 forms of discrimination are used. Action discrimination is involved with action learning and condition discrimination is concerned with limiting the cases when a production is most suitable.

> The process requires that ACT have both correct and incorrect applications of the production. (Anderson, 1983, 245)

If both correct and incorrect applications are available the user has the opportunity of selecting between them and thereby distinguishing their appropriateness.

It is during this second stage of skill acquisition that feedback becomes critically important. In order for users to modify their behavior they must receive feedback to monitor and modify behavior. New users of word processing systems have difficulty dealing with feedback. Their first problem is perceiving feedback from the system when it first occurs. Error messages appearing on a monitor screen often go unnoticed; a computer beep can send a new user into panic, but is often the only time they notice something is not correct. If they notice a response from the system they often have difficulty interpreting what the feedback is telling them and how to evaluate the condition. There are numerous instances of secretaries believing they have made a mistake because they have been unable to interpret the computer's response to the last move. Finally, new users have great difficulty recovering from errors because they are inexperienced in dealing with the system and its response system (cf Carroll and Mack, 1984).

The final method of fine tuning is the strengthening of productions. According to Anderson, at any time several productions will be competing for use in any given situation. The processes of generalization and discrimination will weed out many inappropriate production sequences. However, they may not weed out all of them.

> The strength of a production determines the amount of activation it receives in competition with other productions during pattern matching. Thus, all things being equal, the condition of a stronger production will be matched more rapidly and so repress the matching of a weaker production. (Anderson, 1983, 250)

In this situation the production used will be the one with greatest amount of strength in relation to other competing productions.

ACT* SUMMARY

As a theory of representational learning, ACT* provides a comprehensive model of procedural learning. The mechanisms for this learning have evolved from the early models of skill acquisition and the disparate models of language acquisition and general learning theory. Anderson has attempted, quite successfully, to propose a model to account for all types of learning. In doing so he has cogently described the processes and mechanisms he believes are central to this activity. His description of such varied activities as learning and producing geometric theorems, strategies for playing bridge and a variety of everyday activities all lend credence to his model. Secretaries learning to use a word processing system, as in the present investigation, will in the process acquire knowledge, decision making strategies and behavioral procedures, which seem well accounted for by the ACT* system.

SUMMARY

In this chapter theories of skill learning were discussed in terms of perceptual-motor and cognitive skills. These theories were related back to early theories of associative learning and the debt owed to early theorists such as Bartlett, Guthrie, Tolman. Modern theories of scripts and mental models were presented as a way to account for the first phase of skill learning when the initial task is to identify the task at hand and the overall goal of that task. It was seen that script theories have not been developed sufficiently to account for the processes adults might use to generate an appropriate working model of a task. Studies of mental models have provided much stronger evidence for their development, modification and use by adults in learning situations. Anderson's ACT* theory combine essential elements required to account for the cognitive processing, memory retrieval and motor movements in learning situations involving skill.

The processes involved within ACT* are universal and the individual differences by users are accounted for by the different problem solving solutions each adopts in a given situation and the better or worse execution of the behavioral task.

CHAPTER 3

ADULT CHARACTERISTICS

CHARACTERISTICS OF LEARNERS

The studies on text editing reviewed in Chapter 1 have compounded two difficult areas: that of learning complex cognitive skills and that of learning by adults. In the search for the process of how people learn to use text editing systems, these studies have, at times, neglected the known characteristics of their subjects. In this Chapter, theories from the field of education relevant to this study will be presented. Theories of adult learning and theories concerned with learning styles will be reviewed in relation to the studies of text editing from Chapter 1. Some personality characteristics and attributes which may affect how well people are able to learn will be briefly discussed. In the final section the research hypotheses to be used in this investigation of how adults learn to use a word processing system will be presented.

ADULT LEARNING THEORIES

Most studies about learning focus on students, either children or young adults, in formal educational settings; while most of the research on computer use has focused on university students or adults in the workplace. The bulk of research on adult learning has focused on adults attending some form of formal or informal educational programme. Such learners are often referred to as self-directed learners because they choose what, when and why they are learning. Their courses of study range from craft courses to local history or genealogy to A-level or university level courses. But learning takes place in any situation and most of the learning adults do takes place outside formal educational settings, most often in work situations. To help facilitate learning in these non-formal educational settings it is necessary to consider characteristics of adults and theories based on adults, to explore individual differences in learning to use a word processing system.

CHARACTERISTICS OF ADULT LEARNERS

Adults bring a great deal of background knowledge and experience to learning tasks. This was evident in the studies reported above. In order to understand and make sense of a new learning task, adults typically try to reinterpret the new task in terms of their perceived relevant past experiences. They will start from what they already know. Some of this knowledge and experience will be irrelevant to the task at hand; however, some past experiences will be useful and applicable to the learning of new tasks. Most importantly, most adults can discriminate between past experiences as relevant or irrelevant to new learning situations. In the case of computers and word processing the usual experience secretaries draw on is using a typewriter. So one can assume that a typist learning to use a word processing system begins by noting the similarities between typing and word processing. Perception of the differences between typing and word processing might lead to some resistance because then the typist is forced to acknowledge that a change is necessary. It is often the case that adults will have to unlearn previous skills in order to accommodate the needs of the new learning situation. For example, pressing the enter key at the end of each line when using a typewriter but only pressing the enter key at the end of a paragraph on a word processing system.

There are many differences between the way adults and children learn new things (cf: Darkenwald and Merriam, 1983; Cross, 1981). The place where each usually does the learning is different. We tend to think of children doing the bulk of their learning in school; whereas adults learn either at work or on their own. Several authors have written on the different characteristics between adult and children learners. Knowles (1978, 1984) has developed a theory of adult learning which he calls androgogy. Pedagogy refers to children's learning and androgogy to adults' learning. Knowles believes that there are four main differences between pedagogy and androgogy.

First, the structure and control of adult self-concepts differs from those of children in a number of ways. Children tend to be very dependent on adults and draw their self concepts initially from the adults around them. As children mature they move into a more independent way of life and thereby form more independent self-concepts. Adults will already have formed and modified their self-concepts into unique independent entities. Adults are generally much more aware of what they want to learn and how to get it than children who often have no clear idea of the goals of learning and means of reaching them. Their level of dependency affects their self-concepts in several ways but specifically in terms of the degree of self-directedness they have towards learning. Dependent adults rely on others to direct their learning whereas independent adults rely on themselves.

The second main difference has to do with the role of past experiences. The past experiences of children are not usually perceived to be useful or relevant to the learning tasks they are engaged in. This is partly to do with the limited amount of past experience available and partly to do with the relevance of the past experiences. Children learning to read do not have many relevant past experiences to guide them; whereas for adults there is probably some past experience which can be related to every new learning experience. Adults' past experiences are the basis of their self-identities and therefore provide rich and useful material to bring to learning activities. Their independence allows them automatically to link past experiences with a new learning task. They have a better ability to discriminate the relevant and irrelevant bits than children. As mentioned above, one disadvantage for adults is the interference of previous learning with the new learning. Adults may have to unlearn previous techniques in order to learn techniques appropriate to the new learning situation.

Third, the learning children are engaged in at school is subject oriented, with teachers typically choosing the subjects and topics to be learned. Adults' learning tends to be associated with their specific social roles or developmental stage. In other words children have little choice in what they learn or how they are expected to learn it. Nor do they often know why they are learning certain topics. Adults have much more choice about what and how to learn. Adults do much of their learning within work situations. Much of this learning will be subtle, in the sense that the learning is not evaluated or often acknowledged by others. The introduction of new technologies into offices has forced many employers to make the learning of new skills more explicit. In this situation adults may not have as much choice about whether or not to learn a new skill as they might wish. Nonetheless, they are in a better position to determine its relevance to their own positions and to choose how to acquire the necessary skills.

Finally, as people mature their perspective on time changes. Children learn much that will be useful only when they are much older. Adults tend to learn things which will have an immediate relevancy to their lives (Darkenwald and Merriam, 1983; Knowles, 1978; 1984).

Other differences between pedagogy and androgogy have been described in terms of the orientation to learning, the responsibility for planning, diagnosing needs, formulation of objectives, and the planning of methods to evaluate the learning activities (Knowles, 1978; 1984).

OPTIMAL CONDITIONS FOR LEARNING

Many authors have dwelt on the optimal conditions for learning especially when it is outside formal educational establishments. Six conditions have been put forward by Smith (1982) in his work on how adults learn. His conditions are similar to the characteristics of adult learners noted above. Adults feel the need to learn and have input into what, why and how they will learn. This is similar to Knowles' (1978) view on learning as a mutual activity between teacher and student. The content and process of the learning activity bear a perceived and meaningful relationship to past experience and experience is effectively utilized as a resource for learning. In other words, adults accommodate and assimilate learning to previous experience. What is to be learned relates optimally to the individual's developmental changes and life tasks. In other words, adults are goal oriented. Adults take responsibility as far as is possible with the learning method being employed. Adults learn best in a climate that minimizes anxiety and encourages freedom to experiment. Adults have a choice of where and how to learn that is not available to children. Situations in which adults feel free to learn without stress and anxiety will be returned to. Their learning styles are taken into account. Individual learning styles of children are usually not exploited, whereas with adults overt attempts are made to discover an individual's own learning styles which are then exploited to facilitate learning. Smith describes adult learners as having a different orientation to education and learning; an accumulation of experience; special developmental trends (stages of calm followed by periods of change); and different levels of anxiety and ambivalence from children.

In a related work Rogers (1986) describes the characteristics of self-directed adult learners. He suggests that learning activities are episodic in character, not continuous; that the goal is usually a task; that adults use a wider range of strategies than other learners; and that adults have relatively little interest in overall principles.

DISCUSSION

Most writers are agreed that the primary reason adults attempt new learning activities is to solve problems (cf: Cross, 1981; Brookfield, 1986). Unlike children who must attend school, adults often choose to undertake new learning activities. Adults typically have clear goals for the learning activity whereas children often have no clear goal or knowledge of why they are undertaking the learning activity. Further, adult learners take more responsibility for their learning. Knowles suggests the climate and planning for learning is a mutual activity between teacher and adult learners, whereas with children the teacher carries the full responsibility. In addition, adult learners expect to be involved with diagnosing their own needs, forming teaching objectives and evaluating their performance.

The differences noted above have many implications for the preparation of both teaching or training materials for adult learners. Different techniques might be more appropriate for adults than those used with other learning groups. Rogers recommends several features of learning materials which should be amended for the adult learner.

For instance, Rogers recommends that if learning in adults occurs in short bursts rather then in a continuous stream, then materials for learning should be broken into small chunks. One element of dividing learning units into chunks is that they must be standalone chunks. If learning units are divided into small segments only, as Rogers suggests, then that does not address the difference between adults and other learners. Most teaching materials are already divided into small units. Other learners, notably children, are often set tasks which are contingent to previous and post tasks. Surely units to be learned which can be used in isolation as well as being linked with previous or post materials are better suited to all ages of learners and not just adults. It was noted that adult learners expect to be involved in all aspects of the planning and evaluating of learning. These types of discussions between teacher and student might facilitate learning at all ages because students would then have clearer knowledge of the goals, background and criterial objectives of their performance to be evaluated.

There is a great deal of overlap between the work of Knowles and his theory of Androgogy and the work of Smith and Rogers. There is, however, a subtle distinction which is important here. Knowles has described the characteristics of adults as learners as compared to the characteristics of children as learners. This is the basis for his theory on androgogy. Smith and Rogers have described characteristics of learning from which we can deduce optimal conditions which would foster good learning to take place.

ADULTS LEARNING COMPUTER SKILLS

We need to relate these theories of characteristics of adult learners and optimal learning conditions to adults acquiring computer skills within work situations. Several key features to emerge from this review of adult learning theories will be discussed here in terms of secretaries as they learn word processing skills.

As noted earlier secretaries learning word processing skills are usually proficient typists. Not only do they carry a self-concept as proficient typists but they also come with a self image of being secretaries. Their jobs and their roles in an office give them an image as someone who solves problems, anticipates the needs of supervisors and guarantees the smooth running of the office. When they start to use computers, this self image is put under stress because at the beginning they feel incompetent, stupid, slow and often quite incapable of managing this computer in front of them. Tasks which were easy to manage on a typewriter become slow, cumbersome and quite difficult on a computer. It is important that trainers acknowledge and help secretaries to maintain that good self-image during the difficult initial learning phases. As adults we may have forgotten the slow process of learning, which we knew so well as children. If we remember the struggle to master tying a shoelace or riding a bicycle we will recall the small, often painful, steps it took. And how often we had to re-learn things because we had forgotten them. Adults do not often face learning on such a scale and so may forget how difficult and slow the process can be. But learning a new skill does involve incorporating appropriate parts of previous behavior into new patterns appropriate to the new learning situation. Adults may have to allow themselves a period of unskilled behavior while learning is occurring. This makes most people feel quite uncomfortable.

The wealth of experience which adults bring to the learning situation can both help and hinder. As discussed in Chapter 2, past experiences give adults the ability to be more able to keep the learning activity in a manageable perspective embedded in the rest of their adult life. However, the past experiences may not be relevant to the new learning situation and the mental models produced may not be terribly functional.

ANXIETY AND LEARNING

For learning to occur, an organism (i.e., a person) must have a certain level of arousal. If there is not enough arousal, or too much arousal, then learning will be affected in an adverse way. Activation theory postulates an inverted-U relationship between activation and performance. This postulate now referred to as the Yerkes-Dodson law was first put forward by Yerkes and Dodson (1908). At the time they were studying the arousal and performance level of rats responding to electric shocks. However, their formulation has perhaps been over-generalized to all learning situations. The law can be summarized as follows:

> for every type of behavior there exists an optimal degree of arousal, usually of moderate intensity, that produces maximum performance. Levels of arousal above or below this optimum amount are seen to produce inferior performance. (Marteniuk, 1976, p. 40)

In other words, to learn well implies being in a state of moderate arousal so that the receptor and effectors attend only to the learning situation.

Newell and Rosenbloom (1981) have extended the Yerkes-Dobson law for use in computing skills tasks and refer to it as the power law. This law focuses on speed and error rates to determine most efficient performance on any given task.

The disposition or tendency to be anxious, which describes a range of uncomfortable physical symptoms, is treated by Cattell (1965) as a personality trait. There are 2 types of anxiety relevant to the study of how adults learn to use word processing systems. The first is trait anxiety and refers to the underlying constant level of anxiety that an individual has. Several measures of trait anxiety exist. Eysenck and Eysenck (1975) have developed the Eysenck Personality Questionnaire (EPQ) to measure anxiety along a continuum of anxiety-stability. The second type of anxiety is state anxiety. In this investigation state anxiety refers to the anxiety which is triggered off by the association of using computer technology.

Eysenck suggests that anxiety produces a situation where the learner will be in a high state of readiness, but this conflicts with her ability to carry through actions, and so she makes errors. Also due to her anxiety, less information will be transferred into either STM or LTM, probably because distractions will conflict with this activity.

> The pattern of effects of anxiety on component processes is rather different; anxiety typically increases attentional selectivity, reduces accuracy, reduces short-term storage capacity, reduces long-term memory, and increases distractability. (Eysenck, 1984, 357)

This suggests that secretaries in an anxious state learning to use a word processing system are very aware of the computer and the prompts it produces as well as the researcher's requests for action. But these secretaries may have difficulty recalling relevant information from LTM or STM and processing the information in working memory. Finally, even if they are able to derive a correct solution their anxiety may interfere with their correctly carrying out the editing action.

However, referring to an earlier piece of work, carried out in 1979, Eysenck quotes himself saying:

> anxiety may usually disrupt processing efficiency more than processing effectiveness (i.e., the quality of performance). The quality of performance is maintained under high anxiety despite reduced processing efficiency, because of the use of compensatory mechanisms. (Eysenck, 1984, 356)

Here, Eysenck suggests that to maintain this high state of arousal and carry on with daily activities, individuals develop alternative ways of working around their anxious state and get on with the task at hand. These compensatory processes, presumably, would add to the amount of time needed to work through an alternative method of processing information rather than a more straightforward non-anxious-based process.

Welford (1968) associated activation theory and levels of arousal with the personality dimension of extraversion-introversion also measured on the EPQ. He suggests that this dimension also affects learning and with the dimension of neuroticism-stability allows predictions to be made about individuals' levels of performance.

It is assumed, therefore, that learning will be affected by the subjects' level of anxiety and their level of introversion-extraversion. Secretaries with very high levels of trait anxiety and/or very high levels of state anxiety are expected to perform less well than their less anxious colleagues. Marteniuk, describing Welford (1968) work on activation theory and arousal states:

> In terms of the other personality dimension neuroticism-stability, Welford cites evidence to indicate that neurotic or "unstable" individuals become more easily aroused than stable individuals. From this it follows that an unstable introvert can easily be "pushed over" his optimum level of arousal, which would lead to performance decrement. On the other hand, a stable extravert would conceivably require a relatively large degree of stimulation to reach his optimum level. (Marteniuk, 1976, p 44)

Secretaries in this study will probably show varying degrees of both trait and state anxiety. They will also show variation along the introversion-extraversion continuum. It is expected that by combining level of anxiety and extraversion it will be possible to predict who will learn more efficiently (in terms of speed and accuracy) and who may need assistance to learn efficiently.

MOTIVATION TO LEARN

Another aspect of how well learning takes place is based on the motivation of the individual. For this discussion 2 types of motivation will be considered: extrinsic and intrinsic. Extrinsic motivation brings about external rewards for goal attainment (e.g., money, promotion). The secretaries in this study are under varying amounts of pressure to acquire word processing skills for use in their jobs. Some of them will feel this pressure as external to themselves. In other words, their departments, or supervisors, have told them they must learn word processing. They may have no desire to use a word processing system and may feel compelled to learn in order to maintain their positions. Incentives for learning will change and vary over a lifetime. A reward that was sufficient when one was a child will probably not be seen as sufficient today.

Other secretaries come quite eagerly to learning. They feel an internal desire to gain new skills regardless of whatever external forces are there.

> Intrinsic motivation is related to an individual's interests and aptitudes, and is thus presumably reasonably constant over time. (Eysenck, 1984, p.345)

Most research conducted on motivation has focused on external motivation, usually the incentive to learn being a monetary reward.

Research has suggested that if people are very motivated they perform differently from less motivated individuals, but this may be detrimental to learning because the focus is on the reward rather than on the learning task.

> We know that incentive typically increases speed, decreases accuracy, increases attentional selectivity, increases distractability, increases short-term storage capacity and has no effect on long-term memory or retrieval efficiency. (Eysenck, 1984, 357)

LEARNING STYLE

The exploration of styles of learning has long interested educational researchers. Pask (1976); Marton and Saljo (1976); Biggs and Collis (1982) and the studies by Entwistle and his colleagues (Entwistle, 1981; Entwistle and Ramsden, 1983) have developed methods of assessing learning styles of secondary and university age students in formal educational settings. Learning style theories have posited a continuum with 'deep' and 'surface' levels of processing as the extremes. Deep level of processing describes a method of learning which delves into the material in order to understand and make connections. The typical 'deep' learner is intrinsically motivated to learn and often goes far beyond the set task in order to fully understand a topic. A surface level of processing describes an approach which is more oriented to meeting the set goal of a specific task. Typical 'surface' learners rely on memorization techniques and learn only enough to get by.

As stated above, work on learning styles has focused chiefly on students within formal educational settings. However, in Chapter 1 it was clear that in the Carroll and Mack studies (1983, 1984) and the Czaja et al. studies (1986), adults learning to use word processing systems may use different styles of learning. In the Carroll and Mack studies they suggested adults were using an active learning style which might be associated to a 'deep' level of processing. Czaja et al explored different training strategies which reflect both 'deep' and 'surface' approaches to learning.

In the present study one goal will be to explore possible learning styles used by the secretaries to see whether learning styles can be measured for adult learners and whether learning styles is an appropriate concept in terms of learning to use a word processing system.

ATTRIBUTES WHICH MAY AFFECT LEARNING

Thus far, the discussion in this chapter has focused on theories of adult learning and personality characteristics which may affect learning. Individual attributes of learners will also have an affect on their learning. In particular age of the subjects and their previous computing experience will be addressed here.

EFFECT OF AGE ON LEARNING

Cross (1981), among others, has emphasized the differences between the ability of adults to learn compared to children or young people. The main distinctions appear to be physiological rather than psychological (Kidd, 1973). In and of itself age is not a barrier to learning. We learn throughout our lifetimes. However, there are physical changes which occur as we age and may cause some interference with learning and performance; these will not affect ability to learn. These include changes and deterioration in reaction time, vision, and hearing. In using a computer the older adult may respond less quickly than her younger counterpart. The older secretary may be slower to perceive and respond to changes which appear on a computer screen. Subtle minute changes may not be visualized easily.

Some of the difficulties which older adults might experience in using computers may not be due so much to physical deterioration but to the social acceptance of technological equipment. Older adults may be less knowledgeable generally about technology than younger adults.

The studies of older adults learning to use text editing systems, reported in Chapter 1, indicate that older adults learn as well as younger adults, but perhaps require training techniques which will accommodate to their slower memory functions and physical deteriorations. It was suggested that menu based systems might be easier for older adults to learn to use because of the memory aid available with the menu.

In the present study it is hoped the age range of participants will make it possible further to explore the effect age has on the learning of a word processing system.

THE EFFECT OF PREVIOUS COMPUTER EXPERIENCE

Several studies reported in Chapter 1 included subjects with varying amount of computer experience (eg., Card, Moran and Newell, 1983; Rosson, 1985). These studies suggested that depending on the type of previous experience this would affect the learning to use a word processing system. It is possible that knowing one word processing system may interfere with the learning of another because of differences in editing methods. On the other hand, knowing one system may ease the learning of a second system because the user will have already acquired the underlying concepts and general appreciation for word processing.

In the present study it will be possible further to explore differences between uses on the basis of previous computing experience.

RESEARCH QUESTIONS FOR INVESTIGATION

Several research questions, to be addressed in the thesis, follow from the reviews and discussions of these first 3 chapters. These are presented here.

1: No age differences in learning are expected though older adults may be slower at performing some tasks than younger adults. (Discussed in Chapter 1.)

2: Adults with previous word processing experience are expected to perform more efficiently on experimental tasks though it is possible that errors in execution may occur initially due to interference of previous knowledge. (Discussed in Chapter 1.)

3: Adults with high levels of state and/or trait anxiety will perform less well than adults with moderate or low levels of anxiety. (Discussed in Chapter 3.)

4: Subjects with moderate levels of anxiety and high levels of extraversion will perform better than other adults (following the Yerkes-Dodson law of arousal and performance. (Discussed in Chapter 3.))

5: Adults with high levels of intrinsic motivation will perform better than adults with low intrinsic motivation and those with high extrinsic motivation. (Discussed in Chapter 3.)

6: It will be possible to classify adults as 'deep' or 'surface' learners and there will be significant differences in performance between these groups. (Discussed in Chapter 3.)

7: Conditions of adult learning will be identifiable and these will have an effect on how well subjects perform. (Discussed in Chapter 3.)

CHAPTER SUMMARY

In this Chapter theories of adult learning and styles of learning were reviewed in relation to the learning of a word processing system. The role of anxiety and motivation as personality characteristics were described. Evidence for the effects of age and previous computing experience on learning were examined briefly. Finally, 7 questions to be addressed by the research were proposed for investigation if the present study. The method and results of the investigation will be presented in the following chapters.

CHAPTER 4

METHOD

This chapter is concerned with how this research was conducted. It will begin with a description of the setting in which the research was carried out, followed by a description of the Microsoft Word 5 word processing package. Each of the research instruments used in this investigation will be described in terms of their relationship to the literature reviewed in Chapters 1 - 3. The procedures for data collection and coding procedures will then be described. The research methods used in this study will be compared with methods used in other studies of adults learning to use word processing systems.

This investigation differs markedly from other investigations of how adults learn to use a word processing system. First, the participants were all employees of the University and were expected to be learning to use Word 5 for use in their jobs: thus motivation to learn can be assumed. Second, the data to be collected will provide detailed descriptive information about the editing commands selected and style in which they are used. Third, questionnaires are used to assess secretaries' styles of learning, conditions of learning and background information to compare with performance data. Fourth, the study is naturalistic. The secretaries perform the experimental tasks in their own familiar offices using their own computer equipment.

CHOICE OF RESEARCH TECHNIQUES

In Chapter 1 the studies carried out by Carroll and his colleagues were reviewed which used a method of data collection using Thinking Aloud Protocol or TAP. This is the process by which an individual speaks aloud every thought while performing some cognitive task. It was developed as a research tool by Ericcson and Simon (1980). TAP was considered for use in the present study but rejected on several grounds. First, there is the question of validity as to whether it is possible to carry out two tasks, successfully, simultaneously. It would seem possible that the load on both working memory to process information required for both tasks and the demands to produce different forms of output (verbal to describe an action and the finger movements to perform the action) both verbal and perform two tasks would overload the system. In the case of novice users learning to use the system one might expect confusion to occur when trying to juggle these two, at times, competing activities. A second concern is more practical in nature. In the present study subjects were seen in their normal work situations surrounded by colleagues, supervisors, telephones, etc. Many secretaries felt uneasy, initially, to be filmed, but did feel the tasks were comparable to what they normally were asked to do during any given day. The inclusion of TAP would have made the task less like what they are used to and it was deemed unsuitable in the present study.

Rosson (1985), in her naturalistic study of computer users at the Watson Research Laboratory was able to attach a monitoring programme to the computer system which all subjects used. In this way she was able to record all keystrokes used during the period of study. It was not possible to produce such a program for use with PC computers for the present study. However, the use of video recording provides a very rich source of user information, containing both keystrokes and the verbal interaction between researcher and subject.

As will be seen, secretaries employed in a British University participated as subjects in this investigation. At the time data collection began, all secretaries in the University were being encouraged to attend courses to help them learn how to use Word 5. It was intended that the course would provide a good enough basis for these secretaries to be able to carry out basic word processing techniques and to continue learning on their own. This study was designed with this in mind.

THE RESEARCH SETTING

Shortly before this investigation began the University standardized its word processing training and support program to use Microsoft Word 5. Departments were encouraged to purchase this program for all secretarial users. This decision forced many departments to move into an IBM-PC environment and to adopt a standard word processing package. When the data collection began many secretaries were just beginning to receive their new equipment.

MICROSOFT WORD 5

Word processing packages such as Microsoft Word 5, Word Perfect 5.0, and Wordstar 2000 share many similarities in the sophistication of the functions they carry out. It is very common for designers to incorporate different procedures for carrying out the same task. Typically there is a long way which allows for several selections to be chosen from a menu at one time. The onscreen menu system prompts the user to make selections on different editing functions and may aid users with poor memories. There is often, however, a shortcut system which relies heavily on the function keys and the Ctrl, and Alt keys. Though all the major word processing packages appear to do the same jobs they have each developed a slightly different command structure and shortcut key facility. Training in the use of a specific package is therefore essential for good practice to develop.

The main word processing techniques to be analyzed in this thesis involve the location of text, changing text in some way, inserting new text, deleting text, formatting text, replacing text and file handling. Each of these is discussed in detail below.

PROCEDURES TO LOCATE TEXT

Basic to all word processing editing is the necessity first to locate the position to edit text. Location is therefore the first stage in successfully completing any word processing editing task. There are many ways to locate text, some more or less efficient than others. The most efficient location technique employed depends solely on the current position of the cursor and the position of the text to be edited. It is not possible to say that one procedure is more efficient than any other because location procedures are very task dependent. To locate text efficiently it is necessary for the user to be able to use all the various location techniques and to choose the method most suited to the specific task.

The simplest location technique and one available with any word processing package is to locate text using the 4 arrow keys. These keys allow one to move up, down, left and right through a document. Each key press moves the cursor one point in any direction. Holding down a key will cause the cursor to move more quickly. Most keyboards clearly label the arrow keys. They are usually located just to the right of the QWERTY keys. This makes them relatively easy to use.

Two keys, usually labelled Page-up and Page-down, allow one to scroll up or down through a document one screenful at a time. The advantage of these keys is that they allow one to move quickly through a document. The cursor's relative position on the screen does not change using these keys so that to get to the top or the bottom of the text other keys will be needed. Two other keys labelled (Home and End) move the cursor to the left side of the line or the end of a line.

More advanced locating techniques involves using the 6 keys described above in conjunction with other keys on the keyboard. For example, to move the cursor to the top left corner of a document hold down the Ctrl key and press Page-up. Conversely to move the cursor to the bottom right corner of a document hold the Ctrl key and press Page-down. Using the Ctrl key with the right and left arrow keys makes the cursor jump to the first letter of each word. The Ctrl key and the up or down arrows move the cursor to the beginning of each paragraph.

The next level of techniques for locating text involve using the function keys on the keyboard. In Word 5 F7 highlights a word to the left of the cursor; pressing it again will move the cursor and highlight the next word to the left. F8 does the same action to the right of the cursor. F9 moves and highlights the paragraph above the present cursor position; F10 moves and highlights the paragraph below the present cursor position.

An other method for locating text uses one of two Word 5 commands through the menu system. The search command, activated by pressing escape search allows users to locate text without knowing its location in the document.

The final method of locating text uses the replace command which will locate as well as change text without knowing the specific location.

PROCEDURES TO DELETE TEXT

There are three methods to delete unwanted text within Word 5. In the simplest condition when one makes a mistake while typing in text the Backspace key can be used to erase characters to the left of the cursor. The text deleted in this way is immediately lost permanently and cannot be retrieved. A second method of deleting text is to use the Delete or Del key which deletes text, one character at a time, to the right of the cursor. Text is first located using one of the location procedures and perhaps highlighted. Each time the Del key is pressed the information is stored in an area called the Scrap. This is a temporary storage facility which stores material until the next time the Del or Delete commands are used. The advantage of deleting material to the scrap is that it can then be retrieved. The final way to delete text is to use the Delete command. This is activated by pressing the Escape key and choosing the Delete option from the menu and pressing the Enter key. When text is deleted with the Delete command users have the option of choosing whether the material will be deleted to the Scrap area (by default) or to a glossary item. Saving material to a glossary is a more permanent method of retaining material for possible insertion at a later point.

PROCEDURES TO INSERT TEXT

Text can be inserted into a document in one of two ways. It can be typed in directly from the keyboard or it can be inserted from the scrap or glossary areas using the Insert commands or Insert key. Each of these procedures is described below.

When Word 5 is first entered it is by default in what is called insert mode. This means that any letters typed are inserted one character to the left of the cursor. This gives the impression of pushing all other text to the right along the screen. It is possible to disable this insert mode by activating the overtype facility by pressing F5. In general, however, text is inserted by typing from the keyboard.

It is often useful to insert text which was previously deleted into the scrap or glossary areas of Word 5. To accomplish this the cursor is placed at the position where the text is to be inserted using one of the location procedures detailed above. Text can be inserted most easily by pressing the Insert key; this has the same effect as using the Insert command (activated by following the sequence of pressing Escape, Insert and the Enter keys). Occasionally, the text to be entered is stored within a glossary item - either a Word 5 generated glossary, in the case of Page to get page numbering or Dateprint to insert the date of printing. Glossary items are accessed through the Insert command. Here the glossary item must be named or selected from the list of items available.

PROCEDURES TO CHANGE TEXT

Changing or moving text from one location to another can be achieved in many different ways. In general text must first be located within the document. It is then highlighted in some way. It is then deleted, the cursor moved to the new location, and the text is then inserted. In practice individuals adopt procedures which they feel most comfortable with. Experienced typists think nothing of retyping bits of text whereas novice typists often prefer to delete and then insert text using the procedures available within the Word 5 package. There is no right or wrong way to change text and there is never just one way to make changes. The choices and combinations are limited only by the number of function keys and commands available within Word 5.

Highlighting text is a usual feature of changing text. Once located the user must specify how much of the text is to be changed in some way. Within Word 5 there are many different ways of highlighting text. The simplest is to use the F6 key which acts to extend the cursor. When F6 is on and an arrow key is pressed the cursor appears to grow in the direction of the arrow. This is highlighted text. F7 or F8 each highlight one word at a time moving in either a left or right direction through the text. F6 used in combination with the Ctrl key will highlight text in the same way as using F6 with F7 or F8. F9 and F10, similarly, move up or down the paragraphs of a document. F6 can be used in conjunction with the other function keys to highlight multiple words or paragraphs. Finally a special combination of the shift key with F8 will highlight a complete sentence. Shift with F10 will highlight the whole text an operation necessary when one wishes to carry out character and paragraph format operations throughout a document.

To make changes in a document at the simplest level, text can either be deleted from one location and retyped at another or users might insert the deleted text from the Scrap area, rather than retyping it. Text can be deleted character by character using either the backspace key or the delete key. F5 puts the cursor into overtype mode so that any text typed will automatically overwrite what text is already there. So deleting text in order to insert new text is achieved most simply by backspace, delete key or F5. Text can also be highlighted using the F6 key with other keys and deleted to the Scrap. Inserting from the Scrap or Glossary is achieved by either pressing the Insert key or using the Insert command. So one way to change text is to delete text to the Scrap, move the cursor to the new location and then insert the text from the Scrap.

Another procedure for changing text involves copying text to the Scrap or to a Glossary rather than deleting it. The text can then be inserted at a new or different location. The advantage of using the copying facility is that it is more difficult to lose text inadvertently. However, using the Copy command does mean that often users have to return to the original location to delete the text; making this a three step procedure.

The most sophisticated technique for changing text is to use the Replace command. In this command the user identifies the current text and the new text to replace it. When activated by pressing the Enter key, each occurrence of the text can be displayed and the user has the option of making the replacement or not. The advantage of this command is that it can make one or many replacements throughout a document. In long documents using Replace with the confirmation facility on can make for a very long procedure; with the confirmation set to no then it is possible that text will be changed which should not have been.

Simple or sophisticated changing techniques depend on the combination of keys used to highlight text, delete text, move the cursor to the new location and insert text.

PROCEDURES TO FORMAT TEXT

One of the facilities of word-processing is the ease with which text can be formatted into different type faces, layouts and styles. Word 5 is extremely sophisticated in the transformations possible. Only aspects of formatting as it was used in the present study will be discussed here. However, it should be noted that only basic formatting procedures were addressed in the present investigation. In particular, it is important to note that Tabs and Style sheets were not incorporated at all.

Formatting within Word 5 is divided into types: character formats change characters; paragraph formatting focuses on paragraph functions; division formatting focuses on the total document. For the novice word processor user, one common difficulty is identifying the type of formatting to use at any particular time. It is often difficult for novices to understand the concept of changing how characters look which is different from changing the form a paragraph takes. This is especially evident when users must know when it is essential to highlight text or not. For example with character formatting each character must be highlighted for the formatting to take effect. For changes to a single paragraph the cursor need only be within the paragraph; the paragraph itself does not need to be highlighted. However, when multiple paragraphs are being formatted, they all must be highlighted. Each of the formatting procedures will be discussed separately.

Character Formatting

As stated above characters to be formatted must be highlighted before the formatting commands are given. Formatting can be achieved in different ways. There are two ways to carry out each type of character formatting., using either shortcut keys or the format command. In the simplest type of formatting when one wishes to change the format of a few letters or words, pressing the Alt key and a letter will change the formatting. For example, pressing Alt and the letter b will bold text; Alt and u will underline text. Curiously, to change the case of letters the combination of Ctrl and F4 will change letters from upper to lowercase and vice versa. The other procedure to format characters is to use the Format command followed by the Character sub-command. A menu with all the character options and their current setting is displayed. The command method is particularly useful when several different types of character formatting are required (e.g., uppercase, bold, italics).

Paragraph Formatting

Paragraph formatting involves placement of the paragraph within the page (i.e., centred, left or right justified) indenting paragraphs, line spacing, widow and orphan control. Most paragraph formatting can be carried out using the command sequence or the shortcut keys involving Alt plus a letter. As mentioned previously, the cursor needs only to be within a paragraph for the formatting to be effected. A highlighting procedure is used when multiple paragraph formatting is required.

In the shortcut procedure Alt and the letter c will centre all text in a paragraph; Alt r makes the paragraph right justified; Alt l left justified, and so on. Pressing the sequence Escape, Format, Paragraph, produces the paragraph menu with current paragraph settings displayed.

Division Formatting

As mentioned above division refers to the total document layout. Margins, tabs and page-numbers are three types of division formatting. Like the other formatting procedures described above division formatting is a sub-command of the Format command. Unlike character and paragraph formatting, there are no shortcut keys to carry out division formatting.

The sequence: Escape, Format, Division, Margin displays the Margin menu which allows the user to adjust the four margins of the page; to modify the size of a page; and to specify the location for running heads.

The sequence: Escape, Format, Division, Page-numbers, displays a menu to allow for the location and printing style of page numbers.

UNIVERSITY TRAINING COURSE FOR MICROSOFT WORD 5

The University's Personnel Department with assistance from the Computing Service offers a course on Microsoft Word 5, exclusively, for secretaries which lasts for 3 half day sessions. This course introduces the basic fundamentals of word processing in a user friendly atmosphere.

The layout of the Computing Service Lecture Room allows for 2 people to share 9 pc workstations, a course can have a maximum of 18 course participants. In practice course participants range from between 6 to 18 people. The workstations are networked to a file server to allow use of the HP laserjet printer. The instructor uses a pc attached to a data panel on an overhead projector to display her pc on a screen. As some people prefer to look at a display nearby, monitors are placed within easy access around the room.

The teaching format of the course is a combination of lectures, demonstrations and hands on practical work. The instructor briefly introduces a topic and then demonstrates its use with course participants watching on the monitors. Finally, the course participants try out the topic working in pairs. During the practical sessions the instructor and the course demonstrator provide one to one assistance as necessary.

Course participants receive extensive documentation during the 3 days. Each receives a printed copy of the error-ridden document which secretaries try to correct through the course, with all editing instructions provided. They also receive extensive notes on carrying out the editing functions covered through the course period and the Computing Service documentation on use of Microsoft Word 5. (Appendix 1 contains the documentation received by secretaries attending the Word 5 course.)

Before attending the Word 5 course secretaries are requested to use the online teach yourself program for Word 5 called Learn. Most secretaries have seen the Learn program but only a few used it through its full session. There are always a few people who have never seen what the Word 5 screen looks like, or how to begin to use Word 5. The 3 half day sessions of the course cover all the basic components needed by secretaries to use Word 5 successfully. Other more advanced courses offer tuition on topics such as use of stylesheets, tabs and tables, and other advanced editing techniques.

The Word 5 course has evolved into its typical pattern of 3 half day sessions for several reasons. First, it has been difficult for some secretaries to get away from the office for full days. It seems more manageable to schedule courses so that part of each day can be spent in the office. Second, the amount of material to be covered in the course is quite significant and most people cannot take in new material after several hours. The half day sessions allow for smaller amounts of new material to be introduced and therefore perhaps better retained. Finally, half day sessions encourage people to return to their offices and try to consolidate what they have learned by trying out newly introduced procedures.

RESEARCH INSTRUMENTS

Three questionnaires were devised for this study. The Entering Characteristics Questionnaire (ECQ) is to elicit background factual information on the secretaries about secretarial service, training and types of technological equipment used. Two surveys were designed to assess theoretical approaches to learning and conditions for learning. The Approaches To Learning Questionnaire (ALQ) is based on part of a previous questionnaire used with college students (Richardson, 1989). The Conditions For Learning Questionnaire (CLQ) is based on theories of adult learning (cf. Knowles, 1978, 1984). One standardized measure, the Eysenck Personality Questionnaire (EPQ), to assess secretaries' personality type was also used. Each of these instruments is described in detail below.

The Entering Characteristics Questionnaire (ECQ) is designed to elicit background and general information about secretaries' use of typewriters and previous experience with computer systems (see Appendix 2). The questionnaire is a slightly expanded version of a questionnaire used previously with secretaries in a large scale survey of secretarial computing experience (Hole and Barnes, 1989). Questions asked information about secretaries' age, sex, years employed; types of computer systems and software packages used; individuals' familiarity with some computing terms (e.g., wordwrap); perceived usefulness of different instructional techniques (i.e., lectures, video, practical sessions). In an attempt to gauge respondents' expectations of computers, open-ended questions requested information about what skills they thought they might lose or gain and what they liked most and liked least about using a computer.

The Approach to Learning Questionnaire (ALQ). The purpose of this instrument is to gain understanding of the learning styles of secretaries and in particular how differing approaches to learning may affect learning computer skills within an office environment.

It was stated in the previous chapter that questionnaires of this type have concentrated on student populations (secondary school through university) and have not focused on adult learners. Approaches to studying (or to learning as we prefer to call it) was explored for three reasons: first, to extend this body of work to include adult populations; second to extend this work beyond formal educational settings; and third, theories of adult learning would suggest that adults approach learning situations differently from children or adolescents and it may be that styles of learning as described by theorists no longer apply within an adult setting.

The survey instrument used here is a modification of an approach to studying instrument used by Richardson (1989) which was previously adapted from the original Entwistle studies. The theoretical development and research supporting approaches to learning was discussed in Chapter 3 above. The ALQ measures an individual's deep and surface approach to learning based on the theories of Entwistle (1981; Entwistle and Ramsden, 1983; Coles, 1985). Only statements relating to 'deep' and 'surface' approaching to learning were included in this study. Other dimensions, such as 'relating ideas' or 'syllabus-boundness', which are conceptually related and correlated statistically to the main continuum of deep and surface processing types were not considered in this study because of the differences between school-based learning and learning on one's own. Five statements of each type were prepared using a 5-point Likert type response scale of definitely agree to definitely disagree.

It was necessary to reword study statements from the original Richardson instrument to take account of generalized learning situations (see Appendix 3). Statements that focused on lectures and tutorials or on the lecturer were modified.

In addition, statements to measure the degree of trait and state anxiety (i.e., situational towards computers) and extrinsic and intrinsic motivation have been included. There were 2 statements for each attribute. These statements were written specifically for this study and follow the same Likert style format used for 'deep' and 'surface' statements. The inclusion of anxiety statements is to try to ascertain an individual's level of general anxiety and her anxiety towards computers. It is hypothesized that people who show high degree of anxiety will learn less well than non, or low-anxious individuals. The statements on motivation are included to see if there are differences in how people learn depending on the type and level of motivation they have for learning the task at hand. Knowledge of learning styles, anxiety and motivation can then be compared with actual performance on the experimental tasks, to be described below.

The Conditions For Learning Questionnaire (CLQ) is an attempt to measure the level of support the working environment provides secretaries in which to learn. The statements are based on adult learning theories which posited several optimum conditions for learning to take place. Theories of adult learning and related research were discussed in Chapter 3, above.

Statements were constructed to target each of the main hypothesized optimum conditions for learning as proposed by Knowles (1978, 1984) and found to be relevant issues for adults participating in some studies reviewed in Chapter 1 (cf: Carroll and Mack, 1983; 1984). The CLQ is included as Appendix 4. These conditions include: goal directedness of individuals; perceived mutuality of learning; environmental support (i.e., time to learn as well as physical aids to learning); autonomy in learning; active style of learning; use of past experiences; and learning style. Two statements, of each type, were designed to elicit the degree of agreement/disagreement of respondents using a five-point Likert type scale.

One purpose of including the CLQ is to assess whether all these 'optimum' conditions must be met in order for learning to take place or conversely if no condition is met whether that implies that no learning takes place. Between these two extreme positions it would be useful to determine the degree of flexibility that exists among and between individuals within non-standard learning situations. Finally, several studies, in Chapter 1, recommended that computer training strategies incorporate the needs of adult users by developing materials and techniques which treated the adults as being different from student learners. The underlying differences are those tested here.

PILOT TEST OF INSTRUMENTS

The ALQ and CLQ were piloted with 13 secretaries not participating in this study. Adjustments were made on the basis of their replies and comments. The revised forms were re-piloted with a further 7 secretaries. The ECQ was not piloted as it had been used successfully with over 670 secretaries in previous studies.

The Eysenck Personality Questionnaire (EPQ). A standard measure of personality traits was used to assess the subjects in this study. The EPQ identifies 3 personality clusters which fall along continua. These are: extraversion-introversion; anxiety-stability; psychoticism-rationality; and a reliability measure in the Lie scale. The use of the EPQ is to provide a reliability measure with the anxiety statements used in the ALQ. It would also provide measures to compare with secretarial performance on the experimental tasks.

DIARY

Each secretary was asked to keep a brief diary of all computer activity throughout the period of the study. Information about frequency and duration of computer use as well as main computer activity and reason for stopping were charted. Secretaries were asked to note any problems they encountered and what help or self-help they were able to bring to the situation. Finally, further attendance on courses offered by the Computing Service was noted and the use made of any printed documentation. (See Appendix 5 for the full details of instructions given to subjects on keeping diaries.)

The purpose of the diary was to gain information about the amount of time secretaries spend using a computer between experimental sessions. It was hoped that by knowing how much time and for what activity secretaries used the computer it would be possible to produce a factor based on practice time.

EXPERIMENTAL TASKS

Experimental tasks were devised to measure the performance of each secretary at weekly intervals throughout the study. Four tasks were designed, similar in form and function, so progress during a one month period could be charted.

The first experimental task is of a different format from subsequent tasks. It was assumed that most subjects had limited knowledge of and capability in using a computer until they attended one of the courses offered by the Personnel Department and Computing Service. Since some secretaries were expected to be unable to carry out any sort of computer-related task, it would be inappropriate to set up an experimental situation which subjects regarded either as an examination or one where the majority of subjects would be expected to fail. Therefore for the first task questions about previous computer use and training were asked in a semi-structured interview format, followed by an invitation to show the researcher what computer commands they were able to use. The researcher observed and noted the number of people working in the office, whether they shared computing and or printing facilities, the type of office (e.g., departmental reception, own office). Specific questions concerning the subject's familiarity with the LEARN program (a teach yourself program to learn Word 5) and ability to enter and exit Word 5 were also explored (see Appendix 6 for details of the first session).

In the four subsequent sessions subjects completed an experimental task while their hands were filmed using the computer keyboard. To carry out any editing activities the editing task can be divided into sub-tasks (Card, et al. 1983). To correct a misspelling, for example, the first sub-task is to place the cursor at the location of the misspelling. The second subtask is to correct the misspelling either by deleting the misspelling and typing the correct spelling or to move characters around by deleting and reinserting them in correct positions. Therefore, any editing task has an initial component of locating the cursor in the position to carry out the edit.

Four error-ridden documents were prepared from published sources. The first document came from the Independent newspaper; the subsequent documents were all drawn from Gould (1981). The four documents contain similar editing demands. On each occasion subjects were required to delete, insert, and move text; and format the document in several ways. To carry out these tasks they first had to locate the correct position and where appropriate highlight some text before editing. In order to avoid the possibility of ceiling effects the later tasks involve more editing demands of the same type as well as including a new editing demand with each subsequent task.

Table 4.1 below summarizes the common elements across the 4 editing tasks. In the first editing task only basic editing skills are required. In the second, all previous skills are needed as well with the additional demand of formatting the document into double spaced. In the third session character formatting and page numbers are introduced. In the final session the addition is the requirement of merging documents.

TABLE 4.1

COMMON COMPONENT DISTRIBUTION ACROSS TASKS

COMPONENTS	TASK 1	TASK 2	TASK 3	TASK 4
INSERT word/letters	LOC23	LOC31	LOC48	LOC59
	INS22	INS31	INS42	INS52
MULTIPLE REPLACE	RLOC21	RLOC31	RLOC41	RLOC51
	REP21	REP31	REP41	REP51
	RSUC21	RSUC31	RSUC41	RSUC51
DELETE sentence	LOC26	LOC39	LOC417	LOC511
	DEL21	DEL31	DEL42	DEL52
INSERT title	LOC211	LOC34	LOC415	LOC516
	INS24	INS32	INS44	INS57
MOVE text	LOC210	LOC33	LOC49	LOC517
	MO21	MO31	MO41	MO51
SWAP text		LOC37	LOC46	LOC56
		CH33	CH45	CH54
FORMAT double space		FOR31	FOR46	FOR54
FORMAT margins			FOR47	FOR55
FORMAT page numbers			FOR48	FOR57
FORMAT typeface				FOR56
MERGE files				LOC519
				MERGE5

Procedures. The observational and experimental procedures were as follows. The researcher set up the video camera and focused it on the secretary's computer keyboard. Subjects were asked to turn on the computer; enter Word 5; load a pre-existing document from floppy disk into Word 5 and carry out editing functions as requested by the researcher (see Appendix 7 for full details of instructions used in each session).

Most secretaries work from printed documents so subjects were given a printed copy of the unedited document, identical to the initial version appearing on the screen, once it had been accessed from the floppy disk. All editing instructions were given by the researcher orally so that the order in which secretaries carried out the editing tasks could be controlled. This also had the advantage of having instructions recorded on the video tape which proved an invaluable aid to coding (see Appendix 7).

To make this study as naturalistic as possible all secretaries (except one who at the time had no computer) were seen in their own offices at their desks and usual computers. Secretaries often work in very busy and noisy offices. They often are interrupted in their work. This was true during the experimental sessions, as well. Whenever the telephone rang or someone came in to see the secretary the camera and research were stopped so the secretary could deal with the situation. Though this often disrupted the flow of the editing tasks these interruptions are a natural part of the learning and working environment of these subjects and therefore they are an appropriate part of the collection of experimental data. Secretaries often asked for instructions to be repeated and this was always done. If the secretary asked for help then the researcher would ask questions to try to help secretaries find their own solutions. For example, if asked to go to the top of the document and insert a title, one secretary got the cursor in the top left corner but could not see how to insert a new line. When asked how she thought you would put something in above the top she correctly replied press the enter key, which she then did. Secretaries often were aware of several possible ways to carry out an editing request and would often ask which method they should use. The researcher would reply "Use whatever method you would normally use." At times secretaries took several tries to carry out correctly the required editing task all of these were recorded.

Video recording. A JVC GR707 Super VHS-C camcorder was used during each experimental session to record subjects' hands on the computer keyboard. It was apparent during the pilot phase of the project that secretaries type too quickly for anyone to keep an accurate account of the keys pressed. The camcorder, mounted on a tripod, was set up in as convenient a position as possible so that the subject could work without being encumbered by the equipment but so that the camera could get the full keyboard in focus. It was not possible to locate the camera in a position to record both the keyboard and the computer monitor screen, though this might have helped during the transcription of the data. The angle required to capture the keyboard was quite different for the angle required to capture the screen. For 3 secretaries it was necessary to position the camera in front of them with the result being an upside down picture of the keyboard. Two experimental observations, one on session 3 and one on session 4, were lost due to failures in the recording system. In both instances the tape became mangled and did not record a clean picture. The information was therefore lost. The data for these 2 secretaries on these occasions were scored as missing. Therefore on session 3 N=30; on session 4 N=29 due to one secretary who was unable to complete the project due to illness.

SAMPLE

The final sample was drawn from two groups of secretaries: secretaries newly appointed to the University and current University secretaries new to Word 5.

The Personnel Department sent the researcher a list of newly appointed secretaries each month. The researcher wrote to each secretary about the study and invited them to participate (see Appendix 8). The researcher followed up the letter with a phone call to encourage secretaries to consider participating in the research project. Interested secretaries were given details of the next Word 5 course and instructions on how to register for it. Where possible an appointment was made for the researcher to visit the secretary before the Word course to complete session 1.

The researcher acted as a demonstrator on the Word 5 course and met current University secretaries initially in that context. The secretaries would have judged the researcher as someone more knowledgeable than themselves about Word 5 and would have seen the style of assistance she used. It was hoped this would be a positive incentive for secretaries to join the study. The researcher spoke briefly to each Word 5 class about the study (see Appendix 9). Details of the study were given, in particular, how often the researcher would visit secretaries and over what time frame. She briefly described the sorts of activities the secretaries would be asked to do. There was often concern raised about the use of a video camera but it was stressed that the camera was solely focused on the typists' hands and was used only so the researcher could code what keys were pressed in what order. Another potential difficulty was the timing of visits to offices. All visits were arranged for a time most suited to the secretary.

Secretaries were told that their participation in no way affected their employment, but it was pointed out that participation in the study would provide them with extra support during the period of study.

DATA TRANSCRIPTION

The information required from the video recording was to know what keys were pressed in what order in response to each of the editing commands given. Video tapes were copied to standard VHS tapes and transcribed using a self-designed coding system to indicate cursor movements, function keys, other special keys and letters. For example, F6 arrow indicated that the F6 function key was pressed (i.e. the extend key was activated) followed by the right arrow to extend the cursor to the right. The researcher coded the videotapes using a standard video player with slow motion capabilities. This allowed the researcher to note the keys pressed and their sequence. All errors and their solutions were coded at the same time. This meant that at times one editing request would have several techniques used listed consecutively with the last solution being the correct one. Requests for assistance and comments made were also noted at this stage.

The quality of the recordings was generally satisfactory and the use of a standard 18" screen to view the tapes reduced the chance of errors. Eight tapes, from 2 full subjects, were transcribed by a second person to check on the reliability of the researcher's transcription. One check was of the 4th secretary participating in the study and the second the 21st secretary. Only minor discrepancies were found and it was decided that the researcher's transcription was adequate and no further transcription checks were made.

CODING

A nominal coding system was devised to code the transcribed information to a number format. Obvious codes were pre-selected for each function type. New codes were created as and when a secretary used a new method for completing an editing task. Appendix 10 gives details of the nominal coding scheme. The coding focussed on the overall method used to solve each of the editing demands required during each session. To solve each editing task required at least a 2 stage move: a location move to place the cursor in the correct position; and an editing move (insertion, deletion, change of text, format). Therefore for each editing request there are 2 nominal codes, the code for location and the code for the rest of the edit. A special command with Word

5 is the Replace command. This command makes multiple replacements possible throughout a document. The multiple replace command was coded in 3 ways: the initial location move; the replace command used; and the ultimate success of the procedure.

OVERALL PROCEDURES

Secretaries were seen individually in their departmental offices as soon as possible after agreement to participate in the study and before observations were made. They completed the ECQ and ALQ in the researcher's presence. Instructions on how to use the diary and the importance of noting all computer activity were given (see Appendix 5). Information about previous work experience with computers and computer training was obtained in a short interview during the first session. For this first task it was felt more important for the researcher to provide a supportive environment than to have precise measures of computer skills. As stated earlier the goal of this task was to gain data on computer knowledge and not make demands on subjects to show their computer abilities.

Once secretaries attended the Word 5 course offered by the Computing Service and Personnel Department, subsequent sessions were scheduled. These occurred at weekly intervals for a period of four weeks.

During sessions 2, 3, 4, and 5 experimental tasks were carried out. Once the video equipment had been set up and the secretary ready to begin the researcher gave the secretary a printed copy and a diskette of the document to be edited. It was explained, at each session, that this was not an examination of any kind but instructions for editing the document would be given orally in a fixed order so that the researcher could see how secretaries move around the screen and make changes. The secretary was then instructed to turn the computer on and load the document file from the diskette into Word 5. Once the document was correctly loaded into Word 5 and displayed on the screen the experimental session began. The researcher would give each instruction verbally and then wait for the secretary to carry out the instruction. The instructions used within each experimental session are included in Appendix 7.

After the experimental task any questions or difficulties the secretary had encountered since the last session were discussed. Often these were sophisticated editing procedures which people had attempted to solve on their own.

At session 3 the EPQ was administered at the start of the session. At session 4 secretaries were asked to complete the CLQ. By this visit the new secretaries were expected to be familiar enough with the office and support networks to complete the questionnaire.

TIME-LINE FOR DATA COLLECTION

SESSION	FORMAL MEASURE	SELF-REPORT
1	Completes ECQ Completes ALQ TASK 1	DIARY
	ATTENDS WORD 5 COURSE	
2	TASK 2	
3	Completes EPQ TASK 3	
4	Completes CLQ TASK 4	
5	TASK 5	

Ideally, it was hoped that secretaries would be seen once a week, for approximately 45 minutes, over a 4 week period; often this was not possible due to work and holiday schedules. Several times the span between first and final session was 7 weeks; the norm was 5-6 weeks for each secretary to be actively involved in the study.

The total period of data collection took a year and a half to complete. This was due to several factors. First the Word 5 course was only offered once every 3-4 months. Second, the researcher's teaching schedule precluded much work being completed during the Autumn University term. Third, the experimental sessions took from 45 minutes to 1.5 hours to complete depending on the speed of the secretary, number of interruptions and number of problems requiring attention. It was, therefore, possible to run a maximum of only 6 subjects at a time.

CHAPTER SUMMARY

In this Chapter the methods and procedures used in this study of how secretaries learn to use a word processing system were described. It was seen that several research methods were used to collect data, including the use of surveys, observations and experimental studies. Four videotaped editing sessions from each secretary were first transcribed and then coded for analyses to be described in the remainder of this dissertation.

The methods used were seen to be different yet complementary to previous research in this area and should provide further evidence of how adult learners approach the learning of computing skills. Previous studies have used time and error rate as the performance factors to be measured. In the present study, focus is placed on the procedure used to carry out each editing task in order to explore how secretaries develop word processing skills.

CHAPTER 5

DESCRIPTIVE RESULTS

The results of this study are divided into several sections. The descriptive results are reported in this chapter; comparative statistical results among secretaries performance will be presented in Chapter 6; and results of analyses to investigate individual differences in stylistic use of Word 5 will be reported in Chapter 7.

In this chapter the results from the background questionnaire, the two attitude questionnaires and the Eysenck Personality Questionnaire will be presented first. This will be followed by the descriptive results from the four experimental tasks.

ENTERING CHARACTERISTICS QUESTIONNAIRE (ECQ)

Subjects

Thirty-one university secretaries participated in this investigation. One male secretary participated which reflects the proportion of male secretaries within the University of 1%. An additional 7 women initially agreed to participate in the study but withdrew before the first session. No individuals withdrew having once begun. However, one subject was unable to complete the final session because of a back injury.

Age

Secretaries ranged in age from 1 who was under 20 years to 8 secretaries who were over 50 years old. The average age of participants was within the age band of 36 and 40 years of age. This sample is slightly (but not significantly) older than the average age of secretaries in the University which is closer to 35 years.

Employment Experience

The average length of full-time secretarial employment was 11.16 years with a range of 2 months' to 30 years' experience. Four secretaries had never been employed on a full-time basis. Sixteen secretaries had experience of part-time secretarial employment from between 2 months to 25 years. In fact, 27 of the sample had experience of both part-time and full-time secretarial work.

Length of secretarial service within the University varied from less than 2 months to over 16 years. Secretaries were classified into new or old employees on the basis of length of service. 61.3% (N = 19) secretaries had been employed within the University for less than 6 months. This group were considered as new employees. The remaining 12 (38.7%) had been employed more than 6 months and were considered old employees.

The data on age and length of service together suggest that this group is not a representative sample of secretaries within the University. As a group they are slightly older than secretaries generally within the University and have quite extensive secretarial experience both within the University and outside. As such they have been exposed to different working practices and have undoubtedly worked with a wide variety of equipment and for many different purposes.

Typewriters Used

All secretaries have used typewriters at some time in their careers. Only 2 secretaries reported current use of manual typewriters though 26 had used them previously. Eighteen secretaries reported using an electric typewriter, while 11 said they used one in the past. Eleven secretaries reported using electric typewriters with memory. Typing speeds of the secretaries were reported as varying from 35 to 97 words per minute, though 11 secretaries did not know their speed. Most secretaries only take typing tests during their appointment procedure so many secretaries may not know their current typing speed.

Use Of Typewriters

It is interesting to see what activities were seen to be best achieved by a typewriter rather than a computer. Overall secretaries use typewriters for many different activities. The main use for typewriters was to produce envelopes (29 or 93.5%). Completing forms on a typewriter was another common activity (25 or 80.6%). Writing memos was done by 54.8% (17) and 35.5% (11) used typewriters to produce tables. Only 9.7% (3) of the secretaries said they used a typewriter for the production of manuscripts.

Types Of Computers Used

Many secretaries had used computers in previous employment. Most had also used word processing facilities in previous employment. The length of time using other word processing packages ranged from 3 months to 12 years (Mean = 35 months; sd 34.49 months). The word processing facilities used varied among the market leaders. Seven used a standalone word processing system; 13 used a combination of Wordstar and Word Perfect. Only 2 secretaries had used Microsoft Word in previous employment. Interestingly, 6 secretaries had experience of two or more word processing packages.

The recommended University computer is an IBM-PC compatible. So it is not surprising that 26 secretaries reported using such a machine. However, many secretaries have also had experience using other types of computers at work or home. Of the other types of computers used 7 secretaries reported using stand alone computer systems, such as the Rank Xerox, 7 used Amstrad computers, 5 used Apple computers and 7 used other types of computers. Some secretaries are currently using 2 or 3 different computer systems and one might expect that their knowledge of operating systems and general computing principles would be more extensive than secretaries experiencing use of only one computer type.

Twenty-one secretaries reported using Microsoft Word 5 for between 1 and 5 months (17 reported using Word for 2 months or less) before attending the Personnel/Computing Service course.

Uses Of Computers

Twenty-nine secretaries reported using computers for word processing. The other main use of computers was for database work (N = 18). Spreadsheets were used by 7 secretaries and statistical programs by 3 secretaries. One secretary reported doing computer programming. Much of the work with databases and spreadsheets occurred in employment prior to working within the university. Thirteen secretaries had used computers other than for word processing in previous employment including two women who had used accounting and wage packages.

Computer Training

The Personnel Office and the Computing Service offer many different courses on different aspects of computing and application packages. Secretaries are encouraged to begin their computer training by taking the Word 5 course followed by a course on file management usually referred to as DOS. In the questionnaire secretaries were asked how much tuition they had received and how much tuition they thought they needed for word processing and for DOS. As many secretaries had received computer training in their initial secretarial training, previous employment or FE college it was appropriate to ask about DOS tuition at this point.

Thirteen secretaries had not received any tuition with DOS thus far. Courses ranged from less than 2 hours to 5 days with most people attending a course lasting up to one day. Five secretaries did not feel a need to attend a DOS course. Of the remaining 11 who replied most people requested a course of 1-2 days in duration with a range from less than 2 hours up to 10 days.

Twenty-eight secretaries reported receiving some word processing training though this ranged from less than 2 hours to courses lasting up to two weeks. 1 secretary reported attending a course lasting 2 hours; 2 less than one day of training. Nineteen received between 2-5 days. 6 secretaries attended courses lasting up to two weeks in duration. This last group reflect the number of people who had been trained by Rank Xerox on their standalone word processing system. As the University course typically covers three days this may reflect the high level of response. Of the 18 who replied, 5 felt they did not need any tuition while the others reported needing courses lasting anywhere from 2 hours to 2 weeks.

Familiarity With Computer Terms

One way to try and gauge secretaries' knowledge of computers is to measure their familiarity with standard computer terms. Secretaries were asked how familiar ten different computing terms were to them. The Table below shows how secretaries responded to the question "How familiar are you with each of the following computing terms?" The majority of secretaries felt some familiarity with most of the terms offered; though it seems surprising that after attending a word processing course only 16 people felt completely familiar with the term 'wordwrap' which is a standard term used to entice people into word processing. Thirty secretaries reported some familiarity with the term 'floppy' though only 2 secretaries had used floppy disks in their work. The lack of familiarity with terms such as 'directory' or 'backups' suggests that more work needs to be done to inform secretaries of how files are managed and how to safeguard files. It would have been interesting to have asked for definitions of these terms but it was thought that secretaries would be intimidated by such a request at this initial stage of the study.

TABLE 5.1
SECRETARIES FAMILIARITY WITH COMPUTING TERMS

	Not at all	Fairly	Completely
WORDWRAP	2	13	16
FLOPPY	1	11	19
FILENAME	1	11	19
C DRIVE	4	14	13
FORMAT	2	13	15
WORD	1	18	11
HARD BOOT	17	3	6
CTRL	9	11	9
DIRECTORY	6	16	8
BACKUPS	5	15	9

Instructional Methods

One section of the questionnaire asked secretaries to rate the potential usefulness of different instructional methods to help them learn to use computers. All secretaries reported that practical sessions would be very useful (see Table 5.2, below). Almost all subjects felt that lectures would be useful but differed on whether they would be very useful or just useful. Twenty-seven thought individual tuition would be very useful. Fourteen reported that having recipes to follow would be very useful. At the other end both learning by video and books were thought to not be at all useful by 10 and 12 secretaries respectively. Eight secretaries found group work would not be at all useful.

TABLE 5.2
PERCEIVED USEFULNESS OF DIFFERENT INSTRUCTIONAL METHODS

	Not at all	Somewhat	Very
Practical work	0	0	31
Individual tuition	0	4	27
Recipe	1	10	14
Lectures	6	14	11
Group work	8	15	5
Manual	2	19	9
Texts	7	17	4
Other books	12	8	2
Video	10	14	3

As mentioned previously, the Word 5 course is taught using a combination of short lectures followed by practical hands-on work with demonstrators on hand to help individually. So it is, perhaps, not surprising that these methods were reported to be most useful. Most secretaries reported that following recipes was a useful instructional method. This may be because many secretaries are used to following instructions and find it a useful practice to be told exactly what to do and how to do it. Of course, one difficulty with word processing discussed in Chapter 4 is that there are always many ways to achieve the same end and that there is rarely one best way to carry out word processing functions. This does cause some anxiety amongst users who wish to have a clear idea of what to do and when to do it.

Gains And Losses

Secretaries were asked what benefits and detriments they expected to experience using computers. The majority (29) believed they would gain skills. The most common skills listed to be gained were to think logically or to use analytic skills (mentioned by nine people). Eight secretaries mentioned speed as a gain and six mentioned becoming up-to-date with technology. Five people thought computers would help them improve the presentation of the final work, increase their accuracy and provide them with technical know how. A substantial minority felt that the ability to produce top quality final products would give them personal satisfaction.

Some secretaries thought they would lose skills by using computers. The most common skill to lose was typing accuracy (mentioned by 9 subjects). Other loses mentioned include typing speed and having manuscripts go through many more drafts because it was so easy to make changes.

The final questions in this questionnaire focussed on what secretaries liked most about using computers and what they liked least. There were several different response types for both questions.

Three types of responses were given to what secretaries liked most about using a computer. These were of the machine or word processing program's capabilities; the fun of learning involved in using computers; and the ease of going back and forth with different jobs. Twelve secretaries liked being able to create a good looking final result. Also reported were the program's editing functions (N=9), the ease of making corrections (N=8) the speed (N=7) accuracy, quickness and efficiency (N=2). Six secretaries mentioned learning new things every day while 4 mentioned the fun of learning new things and 4 the challenge of being stretched and learning new things. Finally 2 secretaries mentioned how nice it was to leave work and return to it later without having to start from scratch and 2 mentioned the flexibility of using computers.

There are several things secretaries dislike about using computers. In particular, they are concerned about possible health risks. Eye strain was mentioned by 10 secretaries while another 2 mentioned possible skin complaints. Six subjects do not like to spend so much time learning how to use a new system and new commands in order to do relatively simple secretarial tasks. A few people mentioned their anxiety of deleting or wiping off important material and having to retype it all. Two were concerned about technical problems and 3 mentioned when things go wrong. Finally, 2 people mentioned the frustration in not having WYSIWYG (What you see is what you get) and 2 the general frustration of using computers.

APPROACHES TO LEARNING QUESTIONNAIRE

As discussed in the previous chapter, attitude type statements were used to assess secretaries' approaches to learning. As a first step in the analysis of approaches to learning, frequency distributions were examined to ensure that all statements received negative and positive responses. Only two statements were responded to in one direction only. One of these was concerned with deep structure: "ask myself questions", and the other was concerned with intrinsic motivation: "enjoy figuring out in new way". On reflection, both statements are worded in a way which would make it difficult for individuals to disagree. Results of the intrinsic motivation measure were dropped from further analyses. There are no norms to compare the present results with a wider group as this is its first use with an adult sample in a non-formal learning situation. A further difficulty is the use of only 2 statements on some constructs. Obviously, the questionnaire would have been strengthened by the inclusion of more statements and more extensive piloting work.

Summative scores on 'deep' and 'surface' approaches to learning could range from 0 to 20 with 0 indicating strong disagreement with each statement and 20 a strong agreement with each statement. On the 'deep' measure scores ranged from 8 to 18 (see Table 5.3, below). Scores on the 'surface' measure from these secretaries ranged from 8 to 15 with a Mean of 11.62 (sd = 2.00).

TABLE 5.3
SUMMATIVE MEASURES OF APPROACHES TO LEARNING

	N of items	Mean	SD	Range
DEEP	5	14.07	2.71	8 - 18
SURFACE	5	11.62	2.00	8 - 15
STATE ANXIETY	2	1.55	1.57	0 - 06
TRAIT ANXIETY	2	3.68	1.94	1 - 08
EXTRINSIC MOTIVATION	2	4.55	1.43	1 - 08

A crosstabulation of 'deep' and 'surface' was carried out to examine the relationship of membership within each group. Summative measures of 'deep' and 'surface' were divided to form 3, as equal groups as possible. The results are produced in Table 5.4, below and indicate that while it is possible to categorize adults from this sample as having a 'deep' or 'surface' approach to learning the combined results are not clear-cut. Five subjects are high 'deep' and low 'surface' suggesting a 'deep' approach to learning; however, only 2 subjects are high 'surface' and low 'deep' indicating a 'surface approach to learning. The remaining 24 subjects are scattered throughout the table making it difficult to interpret a learning style.

TABLE 5.4
CROSSTABULATION OF DEEP AND SURFACE APPROACHES TO LEARNING

DEEP	**SURFACE**			
	Low	**Medium**	**High**	**TOTAL**
Low	4	2	2	8
Medium	1	3	7	11
High	5	5	2	12
TOTAL	11	11	9	31

Both Trait and State Anxiety were estimated in this questionnaire. Two attitude statements each were utilized allowing for a minimum score of 0 and a maximum score of 10. The questions on state anxiety focused on anxiety towards using computers. It was felt that one probable hindrance to using computers would occur if secretaries had high levels of anxiety towards computers. The summative scores for trait anxiety ranged from 1 to 8 with a mean of 3.67. 15 secretaries had scores of 3 or less suggesting that trait anxiety as measured with these statements was low for the group. Only 3 secretaries had scores of 7 or 8. High scores would indicate the presence of trait anxiety. For state anxiety the picture is quite different. 10 secretaries had scores of 0 on the summative measure, while another 19 had scores between 1 and 3. Only 2 secretaries had scores of 6 indicating some degree of anxiety towards computers.

A crosstabulation between trait and state anxiety suggests that 18 secretaries report low or medium anxiety of either type and the remaining are anxious towards computers or indicate high levels of trait anxiety (see Table 5.5, below). Three subjects have both high trait and state anxieties suggesting that for these subjects using computers might be very difficult.

TABLE 5.5
CROSSTABULATION OF TRAIT AND STATE ANXIETIES

STATE	TRAIT			
	Low	Medium	High	TOTAL
Low	4	2	4	10
Medium	7	5	3	15
High	1	2	3	6
TOTAL	12	9	10	31

Two statements were also used to measure degree of extrinsic motivation. Summative scores again could range from 0 to 10, and in this sample scores ranged from 1 to 8 suggesting that this sample varies considerably in their desire to be with people. The distribution for this sample is very close to normal with the mode and median of 4 and mean 4.55. As mentioned above, the measure of intrinsic motivation was not effective in discriminating among respondents and will not be discussed.

CONDITIONS OF LEARNING

The Conditions of Learning questionnaire attempted to measure two quite different concepts. First, to see if secretaries felt support and encouragement within their working environment for learning and mastering new skills. Evidence for this could be seen in the ease with which they obtained time off to attend courses, time to practise new skills, and a non-pressured environment which would allow secretaries extra time to complete tasks while in the initial learning phase. Second, theories of adult learning suggest that certain optimum conditions must be present in order for adults to learn.

As in the Approaches to Learning questionnaire two statements were devised for each concept under study. It was hoped that summative scores could be produced.

Table 5.6 below presents the descriptive results for the summative measures. Overall, secretaries were generally in agreement with the statements though there was a range in response patterns.

TABLE 5.6
SUMMATIVE MEASURES OF ADULT THEORIES OF LEARNING

	N of items	Mean	SD	Range
AUTONOMY	2	6.32	1.05	4 - 8
PAST	2	4.07	1.21	0 - 6
PHYSICAL ENVIR	2	3.62	1.65	1 - 6
GOAL	2	5.61	1.23	2 - 7
MUTUAL	2	5.77	1.50	3 - 8
ACTIVE	2	4.71	1.58	2 - 8
LEARN	2	5.29	1.44	2 - 8

On the autonomy measure all secretaries showed a high level of agreement with the statements suggesting that as a group they felt they were autonomous in their learning.

The statements on past experience were to assess the degree to which previous experiences can be used to understand the present. While the majority of secretaries were positive in incorporating the past with present (29 had scores of 4 or more) they did vary in their level of agreement.

Both statements about the physical environment focused on time: Time to try or pressure to be quick. So it may not be surprising that most secretaries felt more negative about this aspect of their environment, with 10 secretaries scoring 2 or less and only 5 scoring 6.

The results of the statements on goal directedness were interesting because while 22 secretaries had scores of 6 or 7, the remaining 9 were spread between scores of 1 and 5. This suggests that a minority of respondents did not feel self motivated.

On the whole, secretaries felt supported in their work by the people around them. Most felt it possible to go to colleagues for help or to ask for support from a supervisor. 24 secretaries had scores of 5 or more with only 7 feeling unsupported at work.

Statements on active learning focused on secretaries' desire to jump into learning situations or feeling confident to go ahead. A significant minority of secretaries (14) seemed to be unable to go ahead without direction, while the remaining 17 secretaries felt able to learn on their own.

Learning style statements were concerned with using teaching aids such as manuals or feeling confident in knowing how to gain skills. Twenty one secretaries had some degree of confidence to find their own way whereas 10 did not feel confident.

The results of this questionnaire suggest that, as a group, secretaries' learning of computing skills supports the theories of adult learning as put forth by Knowles (1984) and others. In particular, these adults exhibit a desire for control over their learning environment and have set themselves goals to reach.

EYSENCK PERSONALITY QUESTIONNAIRE

The Eysenck Personality Questionnaire was administered at the beginning of the third experimental session. It was completed in the researcher's presence while she was setting up the video equipment. The results from this sample compare with the 283 secretaries used in the standardization data during the development of the EPQ. No secretaries scored within the psychotic range. On this scale the sample had a mean of 1.68 (sd = 1.96) compared with Eysenck's mean of 2.24 (sd = 2.24). On the extraversion scale the secretaries in the present study had a mean score of 13.58 (sd = 4.51) compared to Eysenck's secretarial group mean of 13.46 (sd = 5.3). On the neuroticism scale the present sample had a mean score of 10.81 (sd = 5.57) compared to the Eysenck secretarial group mean of 12.67 (sd = 4.32). It would appear from these results that the secretaries show a normal range of extraversion and neuroticism. According to the manual for interpreting the Lie scale no scores were outliers of the rest of the group. This suggests that it is not necessary to exclude any subjects from further analyses.

A crosstabulation of the EPQ neuroticism and extraversion measures shows the distribution of subjects when scores are divided into 3 as equal groups as possible. Ten subjects are high neurotics and 10 are high extraverts but only 1 is high on both (see Table 5.7, below). Three subjects score low on both neuroticism and extraversion.

TABLE 5.7
CROSSTABULATION OF NEUROTICISM AND EXTRAVERSION

NEUROTICISM	EXTRAVERSION			
	Low	Medium	High	TOTAL
Low	3	1	7	11
Medium	4	3	3	10
High	3	6	1	10
TOTAL	10	10	11	31

DIARY

Throughout the course of the study secretaries were asked to keep a log of all their computing activities. This was a relatively easy task if secretaries were not using the computer throughout the day for different activities. However, for experienced computer users this was, at times, quite an onerous task. It is fair to say that some secretaries were quite meticulous in noting down every minute of computing activity in great detail. Others however, often had to resort to guessing how long they spent on a machine and for what types of activities. The number of interruptions also caused difficulty in keeping logs. Having said this, perhaps the results of diary should not be taken as an absolute guide to computer use but rather as providing only a crude indication of time spent. Only 24 secretaries returned diaries at the end of the study, despite follow-up requests in person and by letter. Over the 4 week period between sessions secretaries reported using a computer from between 0 to 87.5 hours with a Mean of 30.23 (sd = 23.82). The median use was 26.25 hours.

Table 5.8, below shows how the data were grouped to reflect the amount of time spent using computers through the course of the study. The computer use of 7 secretaries who did not return diaries was estimated on the basis of their replies in the background questionnaire and initial interview in terms of the type of computer activities they carried out on a day to day basis and their previous computing experience.

TABLE 5.8
GROUPED DISTRIBUTION OF COMPUTER USE BETWEEN EXPERIMENTAL SESSIONS

Hours Per Week	N
< 19	9
19 -30	8
31-40	9
> 40	5

EXPERIMENTAL TASKS

The four experimental tasks required secretaries to edit pieces of published text (see Appendix 7). The first task was an extract from The Independent newspaper (1990). The subsequent tasks were all drawn from The Mismeasure of Man (Gould, 1981). The tasks differed in length and complexity with the simplest first and the most difficult last. For example, in the first session all the changes secretaries were requested to make required use of only the most basic editing techniques; by the last task they were being asked to use very sophisticated techniques which required carrying out a complicated series of moves. For example, to paginate a document uses both the insertion of the page glossary item and then formatting this item as a running head. So while the first two sessions involved documents which appeared within one screen, the latter 2 documents were much longer.

The number of editing tasks also increased throughout the 4 sessions from 25 requests on the first 2 sessions to 44 on the final (see Table 5.9, below). Some instructions were common to all four tasks. For example, in each task secretaries were required to delete a sentence,; to make a multiple replacement; to swap text within a sentence; to move a sentence or paragraph to a new location. In general each instruction required secretaries first to locate a specific piece of text and then to edit the text in some way.

TABLE 5.9
NUMBER OF COMMAND TYPES BY TASK

Action/TASK	1	2	3	4
Location	11	12	17	19
Change	3	6	9	8
Insertion	5	4	4	7
Deletion	1	2	2	3
Format	5	1	8	7
TOTAL	25	25	40	44

One main goal of the present study was to investigate what it is that secretaries do while they learn to use a word processing system. In other words, of major interest here is which commands the secretaries use and when they use them. In many of the studies reviewed in Chapter 1, time was the major dependent variable. Here time was not measured because it was clear that novice users are slow both in deciding which technique to employ and also in executing the specific moves required. Further, given that the data were collected in secretaries' offices during normal working hours, interruptions were commonplace and trying to measure the amount of time an individual took to complete one editing request was not feasible. Therefore, these results are not comparable to the results of the Card, et al. (1983) studies which focused exclusively on time taken to edit, but rather focus on the method chosen to complete an editing request.

The 6 major types of editing function: location, change, deletion, insertion, new formatting and change formatting will be discussed separately, below.

LOCATION

There are six main ways to locate text within Word 5. These were described in Chapter 4. The secretaries in this study used all these techniques with varying degrees of success and confidence over the course of this investigation. Throughout the experimental sessions subjects used several methods to locate text. The variation in percentage of frequency of use of each method may represent a shift in abilities. However, because these secretaries had not, for the most part, settled on the most efficient means to locate text suggests that by the end of the study they were "still finding their way".

In Task 1 using the arrow keys in combination with various functions keys occurred 51.1% of the time (see Table 5.10, below). This was the most common location technique used on the first task. Using the arrow keys alone to locate text accounted for 16.9% of all location actions. Using a combination of CtrlPage+up/down with arrows was used 17.6% of the time. This is to be expected as 3 instructions required subjects to go to the top or bottom of the document. Generally, the two most efficient methods for locating text are using commands to search or to replace text automatically. In the first session the replace command was not used by any secretaries. The Search command was only used 10.7% of the time.

TABLE 5.10
PERCENTAGE OF LOCATION ACTIONS BY TASK

	TASK 1	TASK 2	TASK 3	TASK 4
Search	10.7	3.3	6.2	12.0
Ctrl Pup/down	17.6	6.5	12.9	9.8
Pup/down	2.9	17.7	33.0	18.2
F7/8 c+	51.1	6.5	3.2	7.6
Arrows	16.9	63.0	42.7	38.2
Already there		3.0	.2	3.3
Used Replace			.4	4.4
Used Search on subsequent			1.4	5.5
Help	.7			.9
Unable				.2

In Task 2 arrow only use increased dramatically to 63.0% of all location actions; while secretaries' use of specialist keys decreased their use of the F7, F8 or Ctrl keys to locate text (from 51.1% at Time 1 to 6.5% at Time 2). Interestingly, 17.7% of location actions were performed by using a combination of page up/down and the arrow keys. Subjects attempting to locate text by eye tended to use these keys to scroll through long texts, rather than using the arrow keys on their own. Use of the Search command also decreased to 3.3% but still no secretaries used the Replace command.

In Task 3 arrow use dropped to account for only 42.7% of all location moves while use of Page-up or Page-down was employed 33% of the time and Ctrl Page-up or down to get to the top or bottom of the document was used 12.9%. Use of the Search command was beginning to increase again (6.2%). And for the first time the Replace command was used (.2%). Use of the specialist keys dropped to 3.2% of the time.

In the final task use of the Search command jumped to 12.0% of all location procedures while use of the arrows dropped to account for 38.2% of location moves. The Replace command was used 4.4% of the time. While use of the specialist keys rose again to 7.6%. Overall in this final session the pattern of location procedures employed has shifted away from arrow only or Ctrl Pageup/down to incorporate more finely tuned methods of locating texts.

Secretaries trained before the advent of micro-computer technology are used to locating text by eye alone on a typewriter or proof reading material. It is an enormous shift to allow a machine to do the locating. The unfamiliarity with using a screen or incorporate screens into page lengths may point to why use of the arrow keys is so prevalent during the early stages of learning. In trying to control their new working environment they begin by using the arrow keys in a similar way to rolling paper through a typewriter.

What we see in the use of location techniques is a relatively high level of sophistication at time 1, immediately following attendance on the Word 5 course, followed by a dramatic drop in sophisticated techniques with slow improvement over the period of study.

CHANGE

As described previously, to execute a change instruction correctly the user must locate the text, delete text, move to a new location and finally insert the text. The first location moves were analyzed as location functions (reported above). The other three moves were coded together in a change sequence.

As secretaries, in general, do not mind typing in text, it is not surprising to see the heavy use of first deleting text followed by retyping in text (see Table 5.11, below). Though it is again, interesting that at Time 1 and Time 4 retyping is less frequent than the middle sessions, this may suggest that with experience secretaries rely less often on this technique. Use of the Overtype command serves a similar purpose and this too may reduce over time. Many people had some difficulty deleting and inserting text using the shortcut, Del and Ins keys. This is partially reflected in the amount of help required in the first session (17.45).

TABLE 5.11
PERCENTAGE OF CHANGE ACTIONS BY TASK

	TASK			
	1	**2**	**3**	**4**
Replace	4.3	.5	2.5	7.0
DEL/BAC Retype	32.6	47.3	47.9	41.0
Overtype		15.4	22.5	14.4
F6+C Del Retype	5.4	2.2	1.7	.9
Esc/Del Esc/Ins	37.0	5.4	4.6	7.0
F6+F? del P+/Ins	1.1		2.1	9.6
F6+F? del C+/Ins	15.2	11.5	7.1	9.6
F6+C del C+/ins	1.1	9.3	5.0	7.4
Esc/copy	4.4	.5	1.7	
Ctrl F4		1.6		
Lost It		.5	1.3	1.3
Messed Up	1.1		2.1	1.7
HELP	17.4	4.4	1.3	
Total N	92	182	240	229

Secretaries used the menu system to delete text and again to insert text quite often on the first task (37.0% of the time). This may be a reflection of one of the early lessons of the Word 5 course which concentrated on using the menu system to move text before teaching secretaries how to use the shortcut keys to achieve the same ends. Use of the menu system dropped significantly on all subsequent sessions.

Use of the Replace command was inconsistent across sessions. It will be recalled that the replace command is the most efficient method for making changes to text as it both locates and makes a change in one move. At Time 1 it was used 4.3% of the time but use dropped to .5% at Time 2 and slowly rose to reach a final level of 7.0% at Time 4.

DELETION

In the requests to delete text there was no requirement to add in text. Therefore secretaries had only to locate and then delete the required text. Overall the results suggest that deletion is an activity that most secretaries learn early. Not surprisingly, given secretaries' background with typewriters on the first task, they used the backspace or delete key only 23.3% of the time, whereas on tasks 2 and 4, use was much higher. Table 5.12 shows the range of methods used to delete text. Across tasks secretaries used several techniques, which is an indication that they knew what they were doing even though they may have used the less efficient ways of achieving a result.

TABLE 5.12
PERCENTAGE OF DELETE ACTIONS BY TASK

	TASK			
	1	2	3	4
Del/Back	23.3	50.0	23.4	51.7
F6+C Del	13.3	6.5	23.4	17.2
S/F8 Del		11.3	19.1	11.5
F6+C Esc/Del	30.0	14.5	6.4	1.1
F6/8 Del		16.1	25.5	10.3
Esc/Copy	3.3		2.1	1.1
Overtype	3.3			
Replace				1.1
No Need				1.1
Help	10.0	1.6		1.1
Messed Up	16.7			3.4
Total N	30	62	47	87

The delete menu option was used 30.0% of the time on task 1 but then dropped over the following sessions. This may indicate a growing confidence and ability over the period of study to use the shortcut methods.

Another indication of growing ability is indicated in the diminishing need for help or an inability to delete text correctly over the experimental sessions. On the first occasion secretaries required help or were unable to correctly delete text 26.7% of the time. This high level of need diminished markedly in the subsequent occasions, suggesting that secretaries quickly learned basic deletion techniques.

Over the period of study secretaries were finding methods best suited to their needs. This is shown in two ways: first the shift away from using the Delete command to using the quicker shortcut keys; second, by the concentrated use of four methods: pressing the Del or Backspace key; using F6 in combination with either F7, F8 or the Ctrl key to highlight strings of words and then deleting with the Del key. The constant level of Shift F8 command reflects the sentence deletion instruction common to all tasks.

INSERTION

One thing secretaries know how to do is to insert text. Throughout the study it was obvious that, when asked, they are proficient at typing in new text. Table 5.13, below, shows that in terms of typing new passages of text there were few difficulties after the first occasion. What is interesting to note is that in the Insertion instructions only new text was being inserted; there was no requirement to delete text or to move text in these insertion exercises. Therefore it was inappropriate for secretaries first to delete text and then retype it. Usually this deletion and retyping occurred when secretaries deleted a whole word and then retyped it with the missed letters included. A few secretaries had great difficulty manipulating the cursor to ensure that text was inserted in the proper location. As the study progressed these secretaries became more proficient at correctly carrying out the tasks.

TABLE 5.13
PERCENTAGE OF INSERTION ACTIONS BY TASK

	TASK			
	1	**2**	**3**	**4**
Type New	76.8	92.8	90.8	91.5
Del/Type	1.3	4.5	6.7	3.5
Replace				.5
No Need				3.0
Help	18.7	1.8		1.0
Messed Up	3.2	.9	2.5	.5
Total N	155	111	120	201

On the first experimental session secretaries required help to insert text 18.7% of the time. This usually occurred because some subjects tried to make the task more difficult than it was; they found it hard to believe, at first, that they only needed to type in order to insert text. This rather high level of help is countered by the lower level of correct insertion (76.8%) compared to all subsequent tasks where correct insertion was always over 90%.

FORMATTING TEXT

There are two types of text formatting analysed in this study. The first is to add some type of formatting to unformatted text: for example, to make characters bold, italics, capital letters, to centre a paragraph, add in page numbers. The second type of formatting is when secretaries are asked to change the current formatting to another type of formatting; for instance, to make text bold rather than underlined, or to make a paragraph be right justified rather than left justified.

NEW FORMATTING

The easiest way to add formatting to text is to highlight the text in some way and use the shortcut method of pressing the Alt key and a letter key. On both the first and last occasions this method was used over 85% of the time (see Table 5.14, below).

TABLE 5.14

PERCENTAGE OF NEW FORMAT ACTIONS BY TASK

	TASK 1	2	3	4
Alt + key	88.2	16.1		98.9
Esc format +	6.5	61.3	16.7	
Alt + retype	3.2			
Indent by Tab			50.0	
With Help	1.1	22.6	33.3	1.1
Unable	1.1			
Total N	93	31	30	87

In the middle sessions secretaries reverted to the longer format command method to add in character and paragraph formats. In these middle sessions secretaries requested considerably more help than on the first or last occasions (22.6% and 33.3% respectively). These results add to the suggestion made previously that on the first task secretaries were demonstrating a significant amount of material gained on the Word 5 course. In the middle sessions secretaries reverted to slower, longer methods. By the final session most secretaries were beginning to rediscover shorter, more efficient techniques.

CHANGING FORMATS

Unfortunately, there were no requests to change the format of text in the second experimental session, so results must be considered with this omission. There is some similarity in using efficient techniques across the 3 sessions. To change text formatting the format character or format paragraph command can both remove the initial format and also add in the new format (see Table 5.15, below). Use of the format command increases from 24.6% to 50.4% across the length of study, with only a marginal dip on task 3 (21.9%). On the first occasion secretaries retyped text 24.6% of the time in order to delete the old formatting and add in new. As secretaries are used to typing in text this is not seen as a difficult task to them, though it is not optimally efficient to retype text.

TABLE 5.15
PERCENTAGE OF FORMAT CHANGE ACTIONS BY TASK

	TASK			
	1	**2**	**3**	**4**
Alt + key	13.1		45.7	1.7
Esc format +	24.6		21.9	50.4
Alt + retype	24.6		.5	
Alt + type del	9.9			
Overtype	1.6			
F6 + Alt +	6.6	NO	7.1	1.7
Esc f/d/page		FORMAT	9.0	18.3
Esc f/d/runninghead			.5	3.5
Indent by Tab		CHANGE		1.7
Search Alt +			.5	
		REQUIRED		
With Help	13.1		9.5	13.9
Unable	6.6		5.2	8.7
Total N	61		210	115

Secretaries were unable to carry out formatting tasks and needed help on every occasion. However, it can be seen that on the last session advice was sought 13.9% of the time. This was probably due to the difficult formats requested in the final session. Also in the final session secretaries needed several tries or were unable to format text 8.7% of the time. This also reflects the complicated nature of some of the format requests.

DISCUSSION

The descriptive results of the ECQ, ALQ, CLQ and EPQ indicate that secretaries participating in this study vary in age, secretarial experience, previous computing experience, attitudes towards learning, their perception of support for learning within the workplace, level of neuroticism and extraversion.

ECQ

This sample of secretaries is quite heterogeneous. The age range of the sample covers the full working life of secretaries with adequate numbers of subjects within broad bands of ages to allow for comparisons between ages. Work experience, in terms of general secretarial experience and employment within the University is also quite broad and allows for comparisons. Many subjects in this sample have used computers previously. The nature of this experience allows them to be divided into those who have only had word processing experience and those that have used computers for other activities. The range of offices and number of employees sharing offices also allows for comparisons between working environments and learning to use a word processing system.

ALQ

On the basis of descriptive results alone, it would appear possible to categorize adult learners as exhibiting features of a 'deep' or 'surface' approach to learning. Though the usefulness of such an approach is not obvious from the results found here. One would have expected individuals with high 'deep' scores to have 'low' surface scores and vice versa. However, only 7 individuals fall into those 2 categories (5 are low surface, high deep; and 2 are high surface, low deep). There are 10 secretaries who have a combination of high on one variable and medium on the other. This could be an artifact of dividing the sample into 3 groups.

If other approaches to learning are appropriate for adult learners, as well as students, then one would expect to find a large group of subjects scoring low or medium on both variables. There were 10 such individuals in the present study. The other approaches to learning (such as 'syllabus boundedness') might have described the approach to learning of these secretaries (Richardson, 1989; Entwistle and Ramsden, 1983).

The measures of trait and state anxiety assessed on the ALQ seem more successful. Four secretaries indicated low level of anxiety on both measures while 5 individuals reported high levels on both measures. Four subjects reported high trait and low state anxiety; 6 reported high state and low trait anxiety.

CLQ

The CLQ results are less supportive of the adult theories of learning reviewed in Chapter 3. The results here, suggest that adults vary in the amount and type of support available to them - this is to be expected. However, the fact that all secretaries learned indicates that they were able to learn inspite of what their working or learning conditions are. It may be that because these secretaries attended the same course and received similar support by the same researcher this may have diluted any differences between them.

Secretaries did not, on the whole, report having an active style of learning, such as suggested by the Carroll and Mack (1983; 1984) studies. However, there is evidence, from the experimental data, that secretaries were experimenting with different techniques and trying out alternative methods. Therefore it would appear that the items used in the CLQ did not address, adequately, an active learning style.

This brings up a more general limitation of the CLQ. It is clear, with hindsight, that more items were needed to adequately test the theories of conditions of learning. Though pilot work had been carried out on these statements the pilot sample was perhaps too homogeneous. The pilot group were all experienced University secretaries employed in the same department. It may be that their years of working together in the same academic discipline affected how the CLQ items were prepared.

EPQ

The EPQ results indicate that this sample is well within the normative ranges covered in the standardization of the EPQ and they show a range of neurotic-stable and extraversion-introversion tendencies as one would expect.

According to the Yerkes-Dobson law discussed in Chapter 2 one would expect that mild neurotics would be better learners (N = 10) while the 11 high neurotics and 11 low extraverts would not be as good at skill learning. Overall the 3 subjects who are medium extraverts and medium neurotics should be the overall best learners.

A comparison of the trait anxiety measures used on the ALQ and the neuroticism measure from the EPQ does suggest that both are measuring similar characteristics. This can be seen from the table below which shows that 20 individuals score on the diagonal indicating equal levels of trait anxiety and neuroticism.

TABLE 5.16
CROSSTABULATION OF TRAIT ANXIETY WITH NEUROTICISM

NEUROTICISM	TRAIT			
	Low	Medium	High	TOTAL
Low	9	1	1	11
Medium	2	5	3	10
High	1	3	6	10
TOTAL	12	9	10	31

The results of 4 experimental sessions shows that over a 4 week period secretaries do learn and use editing skills sufficiently well enough to carry out the basic editing of manuscripts. Over the 4 week period they gained in confidence and skills and this is reflected in the variation, both in the editing techniques they attempted as well as the variation in the frequency in using each editing command.

Unlike the skilled subjects in the Card et al.(1983) studies which suggested that each individual user showed a preference and consistency for editing functions, we do not see this in this sample of novice users. It may be that follow-up investigation of these secretaries would have revealed preference and consistent use of techniques but for novice users this is not the case. What is evident is a reliance on the most very basic editing techniques and this may be due to secretaries unfamiliarity with the system, or their lack of confidence in trying to use more sophisticated techniques, or the effects of being filmed while using the computer.

The basic techniques is particularly evident in the reliance on use of the arrow keys only to locate text and the low use of the function keys to locate text over the course of the study.

To delete text we see a reliance for use of the simple backspace key or delete which is most closely associated to deleting on a typewriter. Sophisticated use of the combinations of function keys were rarely used throughout the study.

Within the changing of text we see a continued reliance on using the backspace key and retyping in order to make changes; or use of the overtype facility rather than extensive use of function key combinations and moving text around.

Requests for advanced types of formats of text was one way to make later experimental sessions more difficult than the early sessions. Therefore, some of the formatting requests were only made in later sessions. The results suggest that all secretaries could carry out basic formatting and used several methods to do so. Most had an appreciation for the advanced types of formatting requested even if they took several times or needed help to find a method of doing it.

Novice users also show a degree of exploration in using different editing techniques. This is consistent with the Carroll and Mack (1983; 1984) studies which suggested that novice users are active learners in seeking out editing techniques.

Overall, these secretaries made considerable use of the editing techniques available to them. As a group, they used both the menu command system and the short cut keys to carry out editing tasks. Over the 4 experimental sessions they gained in confidence and most began to find their own ways out of difficulties. They seemed, still to be relying on basic techniques to locate and edit text but were becoming more aware of more advanced methods. Perhaps if these secretaries had been followed up 3 or 6 months later differences in techniques would have been more apparent.

One striking feature of the experimental data is the strong evidence for a recency effect on the first experimental session. Many of the, more sophisticated, editing methods show a higher percentage of use on Task 1 which drops on Task 2. We then see a small rise over the final 2 sessions. The first task took place usually within a few days of secretaries attending the Word 5 course and it would appear that many secretaries retained course material over that time frame. However, with practice and time it appears that these subjects resorted to more basic, and perhaps more familiar, editing techniques for the middle sessions. This recency effect can be seen in use of the specialist functions keys to locate text (51.1%, 6.5%, 3.2%, 7.6%) coupled with use of the arrow keys which, as the most basic technique, shows an opposite pattern of use (16.9%, 63.0%, 42.&%, 38.2%). Also use of the search command (10.7%, 3.3%, 6.2%, 12.0%). In the Change requests we see evidence for a recency effect for use of F6+ a function key deleting the highlighted text moving the cursor and using the insert key to reinsert text (16.3%, 11.5%, 9.2%, 19.2%). The replace command (4.3%, .5%, 2.5%, and 7.0%). In format use of the Alt key (88.2%, 16.1, 0, 98.9%).

CHAPTER SUMMARY

In this Chapter descriptive results from the surveys, self-report diaries, EPQ and the 4 experimental sessions were presented. Overall the results indicate that the secretaries in this sample vary in age, secretarial experience, computing experience and attitudes towards learning and their perception of support for learning within a work environment. The results of the EPQ show this sample to have similar scores on measures of extraversion-introversion and neuroticism-stability.

The results of the ALQ suggest that adult learners in non-traditional learning situations can be categorized in terms of a 'deep' or 'surface' approach to learning. The CLQ results suggest that adult learners can be grouped according to the several conditions of learning.

Comparing the results of the surveys used here with previous work suggests that this sample does not see itself as being active learners, though this may not tally with results of the experimental data to be reported later.

The ALQ and CLQ would have benefited from more extensive piloting work in particular more work was need on items concerned with 'deep' and 'surface' approaches to learning and a greater consideration for inclusion of items concerned with other approaches to learning. The CLQ items provide inconclusive evidence for adults requiring certain conditions in order for learning to occur. These will be explored in later chapters.

Descriptive data for the 4 experimental sessions were presented here in terms of the 6 basic editing techniques used in Word 5: location, change, deletion, insertion, new formatting, and change of formatting. These results were presented in terms of percentage of use by each session.

The results suggest that all secretaries in the sample acquired basic word processing editing techniques over the course of the study. This could be seen by the increasing use of the more sophisticated editing techniques at the end of the study and a decrease in basic editing skills.

The results from this study provide some support the conclusion from the Carroll and Mack (1983; 1984) studies that novice users of text-editing systems use an active style of learning. The results do not provide evidence for the development of individualized editing practices as found by Card, et al. (1983) in their study of skilled users editing techniques.

The variation in subjects' performance on the experimental tasks along with their variation on the ECQ, ALQ, CLQ and EPQ makes it is appropriate to explore comparisons between groups of secretaries. These analyses will be presented and discussed in the following chapters.

CHAPTER 6

GROUP PERFORMANCE

In the previous chapter descriptive results from the experimental sessions were presented. This provided detailed information about the type and frequency of the different editing processes and their components. However, in order to make direct comparisons from one session to another and thereby begin to explore changes in performance over time it was necessary to transform the nominal coding scheme used in the experimental sessions to a coding scheme which would allow scores to be calculated and permit statistical analyses.

Two procedures for transforming the coding were used. The first is based on a hierarchical model of secretarial efficiency or effectiveness (described below) where an individual's editing method is judged 'more' or 'less' efficient. Scores based on this model can be used to compare performance over time and between individuals. The second transformation method creates counts of the number of times each editing function is used and so allows for the examination of stylistic differences between individuals. Results of analyses using the efficiency scores will be presented in this chapter; stylistic differences in using Word 5 will be presented in the following chapter.

CODING SCORES FOR SECRETARIAL MODEL

Two independent judges carried out the editing tasks used in the experimental sessions. The judging was used to complement the researcher's own knowledge about editing processes. The judges had different backgrounds and came to this exercise with different perspectives. One judge was a trained secretary who worked up through the ranks to become the University's Secretarial Training Assistant. She designs and teaches computer courses to secretaries. In addition she is responsible for the computer support required by secretaries. The second judge trained as an academic in a science discipline before moving to the Computing Service and becoming its Education Officer. Both are proficient typists though one received no typing training and prefers to use procedures to move text around rather than retype it. The secretarial assistant, like most good typists, often chooses to retype in order to save time moving text. The researcher's background was also useful in terms of judging secretarial efficiency. For several years the researcher had been employed as a secretary in a university department at the same time as pursuing her academic studies. She therefore understood both the secretarial position and the academic position. Because this study focussed on secretaries learning to use word processors the secretarial position prevailed in those instances of strong disagreement of editing method.

The judges carried out each experimental task following procedures identical to those used by the subjects in the sample. The major difference was that judges worked from the written, rather than the oral instructions given by the researcher. Therefore the order in which editing procedures was carried out by the judges was identical to the order used with the participating subjects in the study.

The judges were asked to write down the method they would use to carry out each editing procedure. From their written notes and discussions it was possible to create a hierarchy of methods from 'most efficient' to 'least efficient'. Efficiency is taken to refer to a combination of the least number of keys pressed as well as the quickest procedure to execute. Secretaries, from their training, are fast typists and it is quicker for a secretary to retype a short section of text than to go through the procedure of highlighting, deleting and then reinserting the text. Non-typists would find the retyping a very slow process. To locate text, typists and non-typists are in a similar position; as when the cursor is in the middle of a document and the next editing task is to insert a title at the top of the document the most efficient way to move the cursor is to use the Ctrl pageup keys which causes the cursor to go to the top left corner of the document (see Chapter 4). Using pageup to scroll up the screen, and pressing the home key to move the cursor to the left side of the top line might be the next most efficient way. The least efficient method would be to use the arrow keys to move both up the screen and to the left. Where disagreements existed a discussion took place between the judges and researcher so a hierarchy of editing methods could be agreed upon. For full details of the hierarchies developed by the independent judges see Appendix 11.

Once a hierarchical scoring system had been created for each of the 4 experimental sessions the nominal coding was transformed into an ordinal coding. The scores ranged from 1 to 6 with 1 being the most efficient method and 6 the least efficient method. At times 6 was scored for methods used by secretaries but not mentioned by any of the judges. On examination, these methods were seen to be less efficient than any the judges had used. The nominal codes were originally stored in an SPSS system file. Recode commands were prepared for each variable to transform the nominal codes into ordinal codes. This information was checked for accuracy before any further statistical work was carried out. The ordinal codes were stored in a separate SPSS system file and used in further statistical analyses, discussed below.

SUMMATIVE SCORING PROCEDURES

The new ordinal codes were combined in several ways in order to carry out statistical comparisons between the 4 experimental sessions and between different groups of individuals.

Overall total scores were calculated by taking the mean score of efficiency across all components within each experimental session.

Core Components

An aggregate score was created by summing the 11 core components common to all 4 experimental sessions (see Table 4.1 in Chapter 4). Lower scores reflect a more efficient method with a score of 11 indicating the most efficient method used for each of the 11 components.

Further aggregate scores were calculated using the 14 components common for sessions 2, 3 and 4 (the original 11 core components plus an additional 3 components common to these sessions). A final aggregate score was calculated for the two final sessions composed of the 16 components common to both (the 11 core components, 3 components common to 3 sessions, and a further 2 components common to the final 2 sessions).

At this stage it became obvious that the 3 subjects with missing sessions were going to present difficulties for the statistical analyses. To explore relationships across sessions it is important to have valid data from all experimental sessions. The loss of 3 subjects seemed unacceptable given the amount of valid information held on them. It was decided therefore to allocate grand mean scores to the 3 subjects sessions concerned. This is a conservative treatment of the missing data but by using grand means this method would reduce the significance of difference between groups (Lindquist, 1953).

FUNCTION SCORES PROCEDURE

To make comparisons across the 4 experimental tasks aggregate scores of components were created on the basis of function. Aggregate scores were created for location, change, insert, delete, new formatting and change formatting techniques. The number of editing procedures varied across sessions so that mean scores for functions were calculated for each experimental session.

STATISTICAL PROCEDURES

The primary statistical analysis used to examine the relationship between efficiency scores across the 4 experimental sessions is the repeated measure ANOVA. This statistic allows for the multiple comparison of means across several groups with related samples. Repeated measure ANOVA is comparable to carrying out a series of paired T-Tests. However, this latter is not appropriate because it would increase the probability of Type I errors. The repeated measure ANOVA is one appropriate way to examine differences between correlated data over several measures in that observations for each subject are treated as repeated measures of the same variable.. The resulting F ratio informs us whether or not there is a significant difference between means of different sessions; like the, more usual, ANOVA, it does not tell us where the specific differences lie. When F is significant it is appropriate to examine the contrast effects to discover exactly where the differences between sessions occur. Contrast results can be examined to identify where significant differences lie.

These analyses are all carried out within the MANOVA program of SPSS. The main interest in this research project is to examine differences across the 4 experimental sessions (see Table 6.1, below). Interest, at this stage, centers on the repeated contrast results which would provide an indication of the difference between sessions 1 and 2 between sessions 2 and 3 and between sessions 3 and 4; that is where most learning has occurred. This is a classic form of time series repeated measures. By default the MANOVA program uses ortho-normalized transformations of original scores to carry out repeated measure analyses. The resulting contrasts are not based on adjacent sessions but rather on the difference between session 1 and 2, between session 4 and 1 and 2, and between session 3 with sessions 1,2 and 4. This model is appropriate for analyses of drug use, as originally described in Winer (1971) and used as the repeated measures example in the SPSS-X manual (1988) and in Stevens (1992). However, for these data it is necessary to request the transform sub-command which transforms the data into a form to allow for repeated contrasts which examine adjacent sessions. In addition to the transform subcommand it is also necessary to specifically request repeated contrasts. The resulting contrasts are not contrasts between pairs of adjacent sessions, but rather contrast the means of previous sessions with the subsequent session: thus

$$T_2 = \bar{X}_1 - \bar{X}_2$$

$$T_3 = \left(\frac{\bar{X}_1 + \bar{X}_2}{2}\right) - \bar{X}_3$$

$$T_4 = \left(\frac{\bar{X}_1 + \bar{X}_2 + \bar{X}_3}{3}\right) - \bar{X}_4$$

In other words the first contrast compares Session 1 and Session 2; the second contrast compares the average of sessions 1 and 2 with session 3; and the third contrast compares the average of sessions 1,2 and 3 with session 4. The print command requests information of overall results of the F ratio as well as information about the cell means, the data transformations used in the analysis, and the resulting contrasts.

TABLE 6.1

SPSS-X COMMANDS FOR RUNNING ONE-WAY REPEATED MEASURES ANOVAS

```
MANOVA TOTAL1 TOTAL2 TOTAL3 TOTAL4
 /wsfactor=gp(4)
 /wsdesign=gp
 /analysis(repeated)
 /transform=repeated
 /contrasts(gp)=repeated
 /print=transform cellinfo(means)
 signif (averf univ gg hf)
 /design
```

One-way repeated measures analyses were carried out on total scores, the core components and the individual function scores. Two-way repeated measures were carried out using measures from the EPQ, ECQ, ALQ and CLQ on the total scores, the core components and the individual function scores.

TOTAL AGGREGATE SCORES

The mean total scores from each of the experimental sessions were examined. Table 6.2 below shows the summary frequency information. We can see that the total mean scores drop across the period of study, providing some indication for a general trend towards more efficient performance. There is also a shift in the ranges across the period of study with the final session showing the lowest range of 2.04 - 3.29.

TABLE 6.2

DESCRIPTIVE STATISTICS FOR TOTAL MEAN SCORES FOR EACH EXPERIMENTAL TASK

Task	Mean	SD	Range
1	3.27	.43	2.63 - 4.20
2	3.18	.44	2.40 - 3.97
3	2.96	.45	2.21 - 4.27
4	2.77	.26	2.04 - 3.29

Further investigation of the relationship between total mean scores across experimental sessions reveals some significant associations between sessions. Mean total scores are significantly related except between task 2 and task 4. See Table 6.3 below.

TABLE 6.3

CORRELATION TABLE FOR TOTAL SCORES

Task	2	3	4
1	.69***	.76***	.39*
2		.61***	.23
3			.54**

N=31
* = p < .05
** = p < .01
*** = p < .001

To examine differences across the 4 sessions on TOTAL scores the one-way repeated measures ANOVA was employed. There were significant differences between all sessions using this measure ($F_{3,30}=23.25$, $p<.001$). The results of the contrast analyses indicate that there were significant differences on contrast measures (see Table 6.4, below). The average of Sessions 1 and 2 is significantly different from session 3. The last experimental session (session 4) is significantly different from the average of the previous 3 sessions. There is no significant difference between sessions 1 and 2. Examinations of the means from Table 6.2 (above) suggest that there is a linear decrease in mean scores across the 4 experimental sessions.

TABLE 6.4

CONTRASTS FOR REPEATED MEASURE ANOVA ON TOTAL SCORES

Contrasts	$F_{3,30}$	p
Session 1 versus 2	2.67	ns
Sessions 1,2 versus 3	25.13	.001
Sessions 1,2,3 versus 4	33.59	.001

SUMMATIVE SCORING FREQUENCIES

Core Components Across 4 Experimental Sessions

Table 6.5 below shows the summary statistics of the 11 variables which make up the core components common to all 4 experimental tasks. The range of possible scores is from a 'most efficient' score of 11 to a 'least efficient' score of 55 so it is interesting to note that the best score achieved was only 17. On the final session there is a noticeable drop in range with a highest score of 40.

TABLE 6.5

SUMMARY STATISTICS OF 11 CORE COMPONENTS ACROSS TASKS

Task	Mean	SD	Range
1	38.26	5.19	30-51
2	33.61	7.99	21-51
3	26.83	8.15	17-50
4	26.83	5.20	19-40

Pearson Product-Moment correlation coefficients were calculated to explore the degree of association between summative measures across tasks.

There were significant correlations between the summative scores of the common variables over the 4 experimental sessions with probabilities less than .01 (see Table 6.6, below). The one non-significant association occurred between the 2nd and 4th sessions ($r = .31$, $N=28$, ns). This may be because of the difficulty of some editing procedures required on these 2 occasions.

TABLE 6.6

CORRELATION TABLE

Task	2	3	4
1	.51*	.64***	.53*
2		.54*	.31
3			.49**

N=31
* = p < .05
** = p < .01
*** = p < .001

A one-way repeated measure ANOVA was carried out on the 4 summative scores to examine differences in performance over the 4 experimental sessions. There was a significant difference between summative scores over the 4 experimental sessions ($F_{3,30}=39.98$, $p<.001$). Examination of the repeated contrast results show that all contrasts are significantly different: session 1 with session 2; sessions 1 and 2 with session 3; and sessions 1, 2 and 3 with session 4 (see Table 6.7, below). These contrasts must be interpreted with some caution because examination of the original means shows that though performance improves from session 1 to 3 it remains at the same level on the final session. This may be due to subjects reaching a ceiling effect on the final experimental task or to the task, itself, having a low ceiling.

TABLE 6.7

CONTRASTS FOR REPEATED MEASURE ANOVA ON 11 CORE COMPONENTS

Contrast	$F_{3,30}$	p
Session 1 versus 2	13.72	.001
Sessions 1,2 versus 3	68.98	.001
Sessions 1,2,3 versus 4	36.55	.001

Core Components Across 3 Experimental Sessions

When the core components of the final 3 sessions are examined one can see that the pattern of improvement continues between the second and third sessions. Table 6.8 below shows the summary statistics of the summative scores used for the 14 variables measured.

TABLE 6.8

SUMMARY STATISTICS OF CORE COMPONENTS ACROSS 3 TASKS

Task	Mean	SD	Range
2	43.19	8.75	31-63
3	37.96	9.63	25-67
4	37.83	6.31	27-51

Comparisons between summative scores across the 3 tasks indicate that there is a significant correlation between tasks 2 and 3 ($r = .60$, $N=31$, $p < .001$); and a significant correlation between tasks 3 and 4 ($r = .45$, $N=31$, $p = .01$) and a non-significant association between tasks 2 and 4 ($r = .33$, $N=31$, ns).

Another way of looking at common scores across the three tasks is to focus only on the 3 variables common to these sessions over and above the other 11 common variables. The table below shows that performance on these three components increases over the course of the investigation rather than improving as we would have expected. This may be an artifact of the method used. More difficult editing tasks were introduced at later sessions of the study and this may account for the apparent lack of improvement in performance.

TABLE 6.9

SUMMARY STATISTICS OF 3 COMPONENTS COMMON ACROSS 3 TASKS

Task	Mean	SD	Range
2	9.58	2.19	6-15
3	11.14	3.19	4-18
4	11.00	2.22	6-15

Core Components Across the Final 2 Experimental Sessions

Summative scores were calculated on the 16 variables common to the final 2 sessions. The summary statistics are presented in Table 6.10 below.

TABLE 6.10

SUMMARY STATISTICS OF CORE COMPONENTS ACROSS 2 TASKS

Task	Mean	SD	Range
3	42.23	10.84	27-79
4	41.89	6.79	29-56

Further statistical analysis reveals that the correlation between the variables common to the final 2 sessions was significant ($r = .36$, $n=31$, $p=.046$). This is not surprising given the similarity in scores on these final sessions. Given the similarities in the means it is not surprising that the paired t-test result was non-significant between these two sessions ($t = .18$, $df=30$, ns).

Looking only at the 2 components common to sessions 3 and 4 we see a slight shift in performance (see Table 6.11, below). The distribution of scores indicate that 16 subjects at the 3rd session and 18 at the 4th session had scores of

2 indicating use of the most efficient method on both components. However, 10 subjects on both tasks had scores of 7 indicating a combination of efficiency over the 2 components. On both tasks there was only 1 individual who used the least efficient method for both components and scored 12.

TABLE 6.11

SUMMARY STATISTICS OF 2 COMPONENTS COMMON ACROSS 2 TASKS

Task	Mean	SD	Range
3	4.27	2.79	2-12
4	4.06	2.74	2-12

FUNCTION SCORES FREQUENCIES

When we examine the efficiency in terms of type of editing function we find a very confused picture which generally suggests that at this beginning stage of learning and using Word 5 secretaries are trying out many different techniques with little consistency. This may be a form of trial and error learning which the secretaries adopted at this early stage of acquiring a new skill such as Thorndike (1898) first proposed. It may also be a method of exploring the capabilities of the editing functions available and finding those functions which are most suited to their needs.

Location

In the previous chapter the descriptive use of location commands was presented. It was clear that use of the arrows was the most common method used to locate text throughout the period of study. Unfortunately, using arrow keys on their own is rarely a very efficient method for locating text. The table below shows that use of location technique is not consistently efficient throughout the course of the study. A mean score of 1 would obviously indicate that the most efficient method was used every time and a mean score of 6 that least efficient methods were used every time. What we have are mean scores of 3.49 to 3.63 which indicate a low level of efficiency. No individual subjects scored below 2.25 throughout the 4 experimental sessions.

TABLE 6.12

DESCRIPTIVE STATISTICS FOR LOCATION SCORES FOR EACH EXPERIMENTAL TASK

Task	Mean	SD	Range
1	3.55	.42	2.60-4.60
2	3.63	.48	2.25-4.25
3	3.61	.51	2.29-4.59
4	3.49	.45	2.32-4.42

An examination of differences between sessions using the repeated measure ANOVA revealed no significant differences ($F_{3,30} = 1.54$, ns). Further examination of the repeated contrasts is not appropriate given the non-significant results. As mentioned previously, correct locating of text can be achieved in many different ways. These non-significant results may reflect the range of location methods available and the difficulty novice users have in choosing one method over another.

Change

Changing text combines a set location, deletion and insertion actions with various text highlighting techniques, some of which can be more efficient than others. The secretaries used a range of techniques throughout the experimental sessions (see Table 6.13, below). Efficiency scores ranged from 1.63 (on the final session) to 5.33 (on the first session). In the first experimental task some secretaries were using efficient techniques but others were quite inefficient. This can be seen in the table below which shows the mean score on the first task to be 3.53. Later in the study efficiency is indicated by the reduction in top of the range scores and smaller standard deviations.

TABLE 6.13

DESCRIPTIVE STATISTICS FOR CHANGE SCORES FOR EACH EXPERIMENTAL TASK

Task	Mean	SD	Range
1	3.53	.90	2.00-5.33
2	2.97	.53	1.67-4.17
3	2.84	.50	2.31-4.38
4	2.90	.65	1.63-4.13

Use of efficient change techniques is significantly different across the 4 experimental session when analysed using the repeated measure ANOVA ($F_{3,30}=9.03$, $p<.001$). Further examination of the repeated contrasts reveal that session 1 is significantly different from session 2 and sessions 1 and 2 are significantly different from session 3. The average of sessions 1, 2 and 3 is not significantly different from session 4 (see Table 6.14, below). Re-examination of the means suggests that linear progress was being made by secretaries over the first 3 sessions. The final session may have introduced slightly more difficult change requests but that secretaries may also have been reaching a ceiling effect as the means of session 3 and 4 are so similar.

TABLE 6.14

CONTRASTS FOR REPEATED MEASURE ANOVA FOR CHANGE

Contrast	$F_{3,30}$	p
Session 1 versus 2	8.67	.01
Sessions 1,2 versus 3	16.05	.001
Sessions 1,2,3 versus 4	4.12	ns

Delete

Techniques for deleting text are acquired relatively early in the learning process. This was seen in the range of techniques used by the secretaries and lack of request for help as the study went on. Use of efficient deletion techniques is evident in Table 6.15, below. By the final session the group mean score had dropped to 2.85 with a commensurate drop in range (1.67 to 5.67) in individual mean scores.

TABLE 6.15

DESCRIPTIVE STATISTICS FOR DELETE SCORES FOR EACH EXPERIMENTAL TASK

Task	Mean	SD	Range
1	3.48	1.96	1.00-7.00
2	2.90	.84	2.00-6.00
3	3.86	1.62	1.50-6.00
4	2.85	.99	1.67-5.67

The repeated measure ANOVA was significant ($F_{3,30}=4.10$, $p<.01$) showing that use of deletion across the 4 experimental sessions was significantly different. Further examination of the repeated contrasts shows that the first contrast between sessions 1 and 2 is non-significant but there are significant differences between the average performance on sessions 1 and 2 with session 3 and between the average of sessions 1, 2 and 3 with session 4. See Table 6.16 below. These results could be expected given the mean scores produced above. The mean score for session 3 was much greater than for the other sessions. As there were several new and difficult deletion tasks introduced in the third session it seems likely that this accounts both for the scores on session 3 and the drop in scores on session 4 when less difficult delete actions were required.

TABLE 6.16

CONTRASTS FOR REPEATED MEASURE ANOVA FOR DELETION

Contrast	$F_{3,30}$	p
Session 1 versus 2	2.47	ns
Sessions 1,2 versus 3	4.75	.05
Sessions 1,2,3 versus 4	5.80	.05

Insert

As noted in the previous chapter, secretaries do know how to insert text but they often make it a more difficult task than it need be. Insertion, as used in this investigation, involves typing in new text in the desired location. Any other type of insertion (e.g., moving text) is not considered as an insertion but a change function. Over the period of this investigation secretaries were asked to insert new text during each task. Inserting text, in this situation, does not require any other editing action. Once the cursor is in the correct location new text is inserted. The table below shows that secretaries' efficiency in inserting new text varies considerably over the 4 sessions. As in other functions it would appear that, initially, secretaries remember what was learned on the course that is, a type of recency effect. They then go through a period of experimentation. In the final session we see an improved level of performance. Evidence for this comes partially from the range in individual scores of mean performance; overall the lowest mean of 1.20 to the largest mean of 5.50.

TABLE 6.17

DESCRIPTIVE STATISTICS FOR INSERT SCORES FOR EACH EXPERIMENTAL TASK

Task	Mean	SD	Range
1	1.43	.42	1.20-2.60
2	2.37	.83	1.75-5.50
3	2.89	.66	2.50-4.75
4	1.79	.60	1.29-3.86

There are significant differences between the use of insertion techniques over the 4 experimental sessions. A repeated measure ANOVA resulted in an $F_{3,30}=36.28$, $p<.001$. Examination of the results of the repeated contrast analysis show that there were significant differences between all sessions (see Table 6.18 below). The mean scores for each session (Table 6.17, above) show that differences are not due to a linear progression. Rather, that the most efficient level of insertion was at the first session, with a significant lessening of efficiency for sessions 2 and 3 and finally a significant drop in mean score on the final session. Given that insertion tasks never vary in difficulty explanation of the fluctuation of efficiency is unclear.

TABLE 6.18

CONTRASTS FOR REPEATED MEASURE ANOVA FOR INSERTION

Contrast	$F_{3,30}$	p
Session 1 versus 2	52.07	.001
Sessions 1,2 versus 3	50.34	.001
Sessions 1,2,3 versus 4	11.56	.01

New Formatting

Overall, secretaries were fairly efficient in adding in new types of formats to the documents. In the previous chapter we saw that there are 2 main ways of formatting text either to use Alt plus a special key or to use the command sequence of pressing the escape key then choosing the format command on the menu followed by the type of formatting desired. For the most part using the Alt key is the most efficient method for formatting text, but there are exceptions. Examples are page numbering which is accomplished only through the menu system, as is division formatting. So it is important for secretaries to know both systems. The range of scores, particularly at the final session, suggest that these subjects are quite proficient at using efficient techniques to format text (see below). Session 2 is anomalous when compared with the other sessions. This is most likely because of the nature of the formatting tasks. During this session secretaries were asked to put documents into double spacing. This was the first time a request which required highlighting the whole document and going into format paragraph to find the appropriate sub-command was given and many secretaries were unfamiliar with the technique.

TABLE 6.19

DESCRIPTIVE STATISTICS FOR NEW FORMATTING SCORES FOR EACH EXPERIMENTAL TASK

Task	Mean	SD	Range
1	1.24	.57	1.00-3.00
2	4.16	1.49	3.00-6.00
3	1.07	.36	1.00-3.00
4	1.06	.30	1.00-2.67

A one-way repeated measure ANOVA was carried out on new formatting to examine possible significant differences in performance across the 4 experimental sessions. The results were significant ($F_{3,30}=110.92$, $p<.001$). An examination of the repeated contrasts shown in Table 6.20, below, shows that all contrasts were significant. This is to be expected given the mean scores. As mentioned above session 2 introduced difficult formatting functions which caused a severe drop in mean performance on this session. This mean would have affected the computation of each contrast, regardless of the similarity of the mean scores on sessions 1, 3 and 4.

TABLE 6.20

CONTRASTS FOR REPEATED MEASURE ANOVA FOR NEW FORMATTING

Contrast	$F_{3,30}$	p
Session 1 versus 2	118.65	.001
Sessions 1,2 versus 3	89.13	.001
Sessions 1,2,3 versus 4	133.97	.001

Change of Formatting

To change formatting means to remove the current formatting and replace it with another. This might occur when a change in print font is desired, or change in character formatting is desired. As described in the previous chapter on the first experimental task secretaries tended to retype text with the new formatting rather than change the formatting. By later sessions secretaries were more inclined to use format replace procedures. This is evident in the table below which provides the summary frequency statistics. It will be recalled that no change in formatting was required in the second experimental session.

TABLE 6.21

DESCRIPTIVE STATISTICS FOR CHANGE OF FORMATTING SCORES FOR EACH EXPERIMENTAL TASK

Task	Mean	SD	Range
1	3.26	1.22	1.50-6.00
3	2.50	1.18	1.20-5.20
4	2.62	1.00	1.25-5.25

On the 3 sessions where change in formatting was required there were significant differences between performance using the repeated measure ANOVA ($F_{2,30}=5.03$, $p<.01$). The results of the repeated contrasts are presented in Table 6.22, below. Sessions 1 and 3 are significantly different. There is no significant difference between sessions 1 and 3 with session 4. The contrast results reflect the means of the 3 sessions. Because the mean score for session 1 was so much greater than the other session this would account for the significance between sessions 1 and 3. Session 4 might be significantly different from session 3 but the average of sessions 1 and 3 are not significantly different from the final session.

TABLE 6.22

CONTRASTS FOR REPEATED MEASURE ANOVA FOR CHANGING FORMATTING

Contrast	$F_{2,30}$	p
Session 1 to 3	15.82	.001
Session 3 to 4	.95	ns

SUMMARY AND DISCUSSION

Overall the results on efficiency suggest that secretaries performance changes over the course of this investigation. However, it is clear from examination of the mean scores that progress for all variables, except TOTAL scores, is not linear. There is a pattern of improvement followed by a dip in performance. These results are consistent with theories of recency learning. Secretaries' performance on the first session may be due, in part, to their recent attendance on the Word 5 course. Session 2, which often shows a deterioration in performance may be due to forgetfulness and a falling back to previous methods. The slow improvement and similarity between Sessions 3 and 4 may indicate the beginnings of learning and an integration of different editing techniques along with a consolidation of techniques required to get the job done. When the overall scores are examined (TOTAL) we do see a linear progression over the 4 week period of investigation. This may indicate that linear progress can only be seen in global terms but when one focusses on the details of learning progress appears quite 'bumpy'.

EFFICIENCY BACKGROUND AND PSYCHOLOGICAL CHARACTERISTICS

In this section results of analyses to explore the relationship between efficiency scores and personality type, office situation, and learning style will be explored in order to understand more fully the underlying contributors to the acquisition of skill.

The examination of differences in performance and psychological characteristics was carried out using two-way repeated measure ANOVAs. Significant results would suggest an interaction between efficiency and the characteristic under study; non-significant results suggest that there is no interaction between efficiency and the characteristic under investigation. In all statistical analyses of contrasts it is the interaction between efficiency and the characteristic under study which is reported.

ECQ AND EXPERIMENTAL RESULTS

Relationships between age, previous computer use, length of university employment, type of office, number of people in office, current job status and performance were studied.

The first step in carrying out these analyses was to divide ECQ variables to form 2 or 3 groups of subjects. Group membership for each ECQ variable is listed in the Table below (Age is described separately below). 'Type of office' was divided into those that were quiet single offices where secretaries worked for 1 or 2 individuals; shared offices were scored as 2 and general reception offices or open planned offices were scored 3. The number of employees in an office was scored for those who worked alone, those who shared an office with 1 other individual and those who shared with 2 or more other people. Length of University employment was grouped on the basis of less than or more than 6 months University experience. Job status was divided into 2 groups with 1 being supervised individuals and 2 being supervisors or working on their own. Previous computer experience was divided into 2 groups with 1 being no previous computer experience and 2 having some experience. Finally, practice was based on the self-report diaries secretaries were asked to keep throughout the period of study. As mentioned previously (Chapter 5), only 24 secretaries returned diaries and they varied enormously in the amount of detail recorded which makes their reliability questionable. However, for the present analyses secretaries were divided into those who reported using Word 5 for less than 25 hours and those who reported using Word 5 more than 25 hours during the period from the first session to the last session.

TABLE 6.23

NUMBER OF CASES FOR EACH ECQ VARIABLE

	1	2	3	
Type of Office	8	9	14	
Number in office	10	13	8	
Length Uni	19		12	
Status	15		16	
Previous comp	18		13	
Practice	12		12	(N=24)

Age

Any analyses exploring relationships between age and performance are somewhat contentious because of the possible training implications of reporting better or worse results for different age groups. It was decided, therefore, to investigate possible age differences in efficiency by dividing the subjects into several different grouping schemes and carrying out repeated measure ANOVAs. With only 31 subjects in the sample, at the most, it would be possible to form 4 groups for the repeated measure design. However, it might be that dividing subjects into 2 or 3 groups would provide more appropriate groupings. To form 2 groups, subjects were divided by those who were 40 or under (N = 12) or those over 40 (N = 19). The results in the table below indicate that there were no significant differences in efficiency measures between age groups except in the case of New Formatting ($F=4.75$, $p<.01$). To form 3 groups subjects were divided into those aged 35 and under (N=6); 36-45 (N = 12); and 46 and over (N = 13). There were no significant differences between the 3 age groups and the efficiency measures except with New Formatting ($F=2.33$, $p<.05$). Finally, subjects were divided into 4 age groups: less than or equal to 30 (N=6); 31 to 40 (N=7); 41 to 50 (N=11); and over 50 (N=8). There were again no significant differences between 4 age groups in measures except for New Formatting ($F=2.37$, $p<.05$).

TABLE 6.24

REPEATED MEASURES ANOVA F-RATIOS FOR AGE TIMES EFFICIENCY ON EXPERIMENTAL TASKS

	Number of Age Groups		
	2	3	4
Location	.54	.40	.75
Change	1.25	.67	.73
Delete	1.13	.13	.87
Insert	.24	.74	.53
For Ch	2.34	.31	1.15
For New	4.75**	2.33*	2.37*
Task	.78	.38	.81
Total	.94	.34	1.21

* $p < .05$; ** $p < .01$; *** $p < .001$

To explore the relationship between age and new formatting it is appropriate to look at Hotelling's T^2, the repeated contrasts and the means for each group. These are all presented in the table below. Hotelling's T^2 are significant with all groupings of age, indicating that there are significant differences between groups. However, the contrasts vary across the 3 groupings of age. A close examination of the means and the original coding of age suggests that secretaries between 36 and 45 score differently from other age groups on the New formatting measure. There is no obvious explanation for this, except to suggest that young secretaries may tend to be more open to learning to use computer technology and come with an expectation of learning; the oldest secretaries approach learning computing in one of 2 ways, either showing resistance to it, or an openness to learn a new skill. The middle aged secretaries are often just returning to work after having children and feel threatened by all the changes that have taken place in secretarial work.

TABLE 6.25

HOTELLING'S T^2, REPEATED CONTRASTS AND MEANS FOR DIFFERENT GROUPINGS OF AGE

	2 groups		3 groups			4 groups			
Hotelling's T^2	.43*		.83**			1.28**			
Contrasts									
1 with 2	6.47*		9.18***			6.67**			
1,2 with 3	4.58*		1.46			1.77			
1,2,3 with 4	2.23		.01			1.31			
Means									
Task 1	1.39	1.14	1.78	1.22	1.00	1.93	1.00	1.24	1.00
Task 2	3.50	4.16	3.50	4.00	4.62	3.60	3.43	4.36	4.88
Task 3	1.17	1.00	1.00	1.16	1.01	1.00	1.29	1.00	1.01
Task 4	1.00	1.09	1.00	1.14	1.01	1.00	1.00	1.16	1.00

* $p < .05$; ** $p < .01$; *** $p < .001$

These results with different ways of grouping subjects on the basis of age suggest that age is not a factor affecting secretaries' level of efficiency in this study. Further, it suggests that all age groups learn and any differences between them are not systematic.

Turning now to the other measures explored from the ECQ the table below shows that only location and the 2 formatting measures were related to characteristics of the sample. These are discussed below.

TABLE 6.26

REPEATED MEASURES ANOVA F-RATIOS FOR ECQ MEASURES TIMES EFFICIENCY IN EXPERIMENTAL TASKS

	OFFICE	NO.EMP	UNI	STATUS	PREV	DIARY
Location	2.79*	2.50*	4.43**	3.02*	1.27	1.76
Change	.47	1.77	.41	1.71	.19	1.17
Delete	1.82	1.25	.55	.50	.45	.31
Insert	.32	.42	.57	.41	.64	.89
For Ch	2.45	.78	1.06	2.12	.10	3.40*
For New	1.04	1.58	13.89***	4.38**	.48	3.71*
Task	.32	.75	.38	.45	3.32*	.26
Total	1.76	1.73	2.02	2.14	2.01	2.17

* $p < .05$; ** $p < .01$; *** $p < .001$

Location. Secretaries' efficiency in location moves was related to the activity level of an office, the number of people working within an office, length of university employment and job status (see Table 6.26, above). Further examination of the results show that only activity level of an office and length of university service had significant results with Hotelling's T^2 (see Table 6.27, below). Both these measures also show the same pattern of contrast results; significant results between sessions 1 and 2 and between sessions 1,2, and 3 with session 4; and non-significant contrast results between sessions 1 and 2 with session 3 (see below). The number of secretaries employed in one office had a significant contrast ($T^2 = 4.54$, $p < .05$) while secretarial status produced no significant contrasts.

TABLE 6.27

HOTELLING'S T, REPEATED CONTRASTS AND MEANS FOR LOCATION BY ECQ MEASURES

	Office			Number Emp			Length Uni		Status	
T^2	.66*			.53			.66**		.30	
Contrasts										
1 with 2	3.54*			1.01			8.24**		2.53	
1,2 with 3	1.78			1.88			1.33		2.75	
1,2,3 with 4	3.77*			4.54*			6.87*		3.67	
Means										
Task 1	3.84	3.54	3.37	3.76	3.54	3.30	3.41	3.78	3.48	3.61
Task 2	3.85	3.49	3.59	3.87	3.58	2.41	3.54	3.77	3.56	3.70
Task 3	3.81	3.56	3.61	3.81	3.66	3.29	3.52	3.76	3.59	3.63
Task 4	3.38	3.64	3.49	3.39	3.63	3.49	3.54	3.41	3.61	3.37

* $p < .05$; ** $p < .01$; *** $p < .001$

Change in formatting was affected by the practice variable as measured through the self-report diaries kept by the secretaries ($F = 3.40$, $p < .05$). Hotelling's T^2 was non-significant ($T^2 = .32$). The means, reported in the table below, suggest that secretaries who used the computer in the high practice group showed a drop in formatting scores on the 3rd experimental session then an increase on the final session; whereas the low practice group showed less of a drop on the 3rd session but continued to improve for the final session.

New formatting was affected by length of university employment, job status, and practice effects. Table 6.28, below shows that only length of university employment produced a significant Hotelling's T^2 ($T^2 = .70$). There were significant differences between sessions 1 and 2 and between the average of sessions 1 and 2 with session 3. All measures showed a significant effect between sessions 1 and 2 with session 3. As stated previously, these results would be expected given the introduction of several difficult new formatting tasks on the 2nd session.

TABLE 6.28

HOTELLING'S T, REPEATED CONTRASTS AND MEANS FOR NEW FORMATTING BY ECQ MEASURES

	Uni		Status		Practice	
Hotelling's T^2	.70**		.27		.36	
Contrasts						
1 with 2	5.58*		.48		.02	
1,2 with 3	18.25**		5.85*		5.08*	
1,2,3 with 4	.02		.02		1.83	
Means						
Task 1	1.25	1.22	1.18	1.29	1.53	1.08
Task 2	3.47	5.25	3.60	4.69	4.75	3.50
Task 3	1.11	1.00	1.13	1.00	1.00	1.17
Task 4	1.09	1.01	1.11	1.01	1.40	1.07

* p <.05; ** p<.01; *** p<.001

Only previous computing experience was related to the 13 core components (TASK), though Hotelling's T^2 was non-significant (T^2=.32). Examination of the means (see Table 6.29, below) indicate that the secretaries with previous computer experience showed a significant improvement between sessions 1 and 2 and continued to improve through sessions 3 and 4. The group with no previous experience showed improvement between sessions 2 and 3.

TABLE 6.29

MEANS FOR PREVIOUS EXPERIENCE BY TASK

	NONE	SOME
Session 1	38.67	37.69
Session 2	36.89	29.08
Session 3	28.17	24.97
Session 4	27.39	26.06

Length of university employment and job status are related in that new secretarial employees tend to be placed in more junior supervised positions. These lower grade secretaries may be more likely to work in shared offices. The busier offices tend, in the University, to be general reception offices which also tend to be staffed by secretaries on lower employment grades; therefore there may be an interaction between level of activity of an office, number of employees within an office, length of university employment and job status. There were insufficient numbers in the sample to investigate this more fully. It may be that this effect is showing up in location efficiency because there is so much choice available to location techniques and it may be that interruptions and work pressure affect which methods are selected.

SUMMARY

It is perhaps reassuring that no significant age differences emerged on measures of efficiency and that adults of all ages can expect to acquire new skills. It was expected that word processing efficiency would be significantly affected by several other criteria on the ECQ. In particular the lack of a significant relationship with previous computing experience is surprising as one would assume that it would confer advantage when learning a new computing skill. Perhaps Word 5 skills are different in character from the previous computing skills acquired by some secretaries. Alternatively, previous computing experience may have other, more subtle, effects on computer use than were measured is this investigation. For example, it may be that using computers makes people more confident but not necessarily more knowledgeable about computing.

EPQ AND EXPERIMENTAL RESULTS

Repeated measure ANOVAs were carried out using the EPQ and the aspects of efficiency measured. As so few secretaries showed evidence of psychotic behaviour this variable was excluded from these analyses. Groups were formed on both the neuroticism and extraversion measure of the EPQ. The procedure used was to divide the distribution into thirds of as equal size as possible. The neuroticism groups were formed as follows: 'Low' neurotics had scores less than 8; 'medium' neurotics has scores between 9 and 12; 'high' neurotics had scores greater than 12. 'Low' extraverts had scores on extraversion less than or equal to 10; 'medium' extraverts scored between 11 and 16; 'high' extraverts had scores of 17 or above. The Table below shows the number of cases in each group.

TABLE 6.30

NUMBER OF CASES WITHIN EPQ SUB-GROUPS

	LOW	**MEDIUM**	**HIGH**
Neuroticism	11	10	10
Extraversion	10	10	11

Two-way repeated measure ANOVAs were computed. In the two-way analysis the 4 experimental sessions are analyzed by either the 3 levels of neuroticism or 3 levels of extraversion. It was hypothesized that subjects with high neuroticism scores would differ significantly from subjects with low neuroticism scores in the light of the effects on anxiety on learning. It was also hypothesized that high extraverts would differ from low extraverts in their efficiency scores due to differences in the ways introverts and extraverts interact with people and the effect this might have on learning. The results are presented in the table below and indicate that there are no significant differences between any measure of efficiency and different levels of Neuroticism and Extraversion.

TABLE 6.31

F VALUES FOR NEUROTICISM AND EXTRAVERSION TIMES MEASURES OF EFFICIENCY

EFFICIENCY MEASURE	NEURO	EXTRA
LOCATION	1.07	.93
CHANGE	.68	.65
DELETE	1.94	1.15
INSERT	.38	.35
CHANGE FORMAT	.90	.83
NEW FORMATS	.66	1.35
TASK	.41	.34
TOTAL	.59	.20

The hypotheses stated above were all rejected on the basis of the results. The lack of significant differences on both the neuroticism and extraversion measures and efficiency suggests, at this stage, that level of anxiety and level of extraversion do not affect people's ability to learn the computing skills which constitute Word 5.

ALQ AND EXPERIMENTAL RESULTS

The different features of adult learning described in Chapter 3: deep and surface types of learning, trait and state anxiety, and external motivation were also compared with the summary efficiency results using repeated measure ANOVAs. Groups were formed for deep and surface structures and trait anxiety by dividing the distribution into 3 groups. State anxiety and external motivation were divided into 2 groups because the distribution of scores did not allow for 3 equal groups to be formed. The resulting groups are presented in Table 6.32, below.

TABLE 6.32

GROUP MEMBERSHIP FOR REPEATED MANOVA ANALYSES

Group	LOW	MED	HIGH
Deep	8	11	12
Surface	10	10	11
Trait	12	9	10
State	10		21
External Mot.	16		15

The two-way repeated manova results for all ALQ measures are presented in Table 6.33, below. There are only 2 significant results deep with total and external motivation with change formattings. All other results are non-significant.

TABLE 6.33

REPEATED MEASURES ANOVA F-RATIOS OF ALQ MEASURES TIMES EFFICIENCY ON EXPERIMENTAL TASKS

	DEEP	SURF	TRAIT	STATE	EXT MOT
Location	.32	.38	1.65	1.57	.93
Change	.58	.65	.37	.84	.86
Delete	1.13	.08	1.05	.73	.82
Insert	1.57	1.34	.78	.83	.89
For Ch	1.09	2.35	.09	.09	3.33*
For New	.81	.17	.66	.63	.91
Task	2.10	.74	.85	.71	.94
Total	2.23*	.62	.49	.61	1.10

* $p < .05$; ** $p < .01$; *** $p < .001$

Hotelling's T^2 for deep by total was non-significant ($T^2 = .41$, ns) indicating there were no significant differences between the groups. The means for all groups are presented below and show how little means varied between groups or across sessions.

TABLE 6.34

MEANS FOR DEEP BY TOTAL

	LOW	MED	HIGH
Session 1	3.23	3.18	3.33
Session 2	3.22	2.98	3.34
Session 3	3.07	2.92	2.91
session 4	2.74	2.84	2.73

Turning now to the significant external motivation by change in formatting we find that Hotelling's T^2 is non-significant at .17 and there are no differences between different groups across session. This is confirmed by inspection of the means presented in the table below.

TABLE 6.35

MEANS FOR EXTERNAL MOTIVATION BY CHANGE IN FORMATTING

	LOW	HIGH
Session 1	2.97	3.57
Session 3	2.31	2.71
Session 4	2.91	2.31

It had been hypothesized that significant differences in efficiency would emerge in measures on the ALQ. The pattern of results suggest that as measured, there are no relationships between learning computing skills and levels of anxiety (trait and state), external motivation and learning style as measured through deep and surface styles of learning.

CLQ AND EXPERIMENTAL RESULTS

The relationship between the features described in Chapter 3 of the conditions of learning and efficiency measures were explored using the repeated measure ANOVAs. The measures of autonomous learning, influence of past experience, the current physical environment, mutuality of learning, active learning mode and learning style were compared to efficiency measures across the 4 experimental sessions. Groups were formed by dividing subjects into 2 or 3 groups.

TABLE 6.36

NUMBER OF CASES WITHIN CLQ SUB-GROUPS

	LOW	MEDIUM	HIGH
Autonomy	17		14
Past Experience	6	17	8
Physical Environ	10	10	11
Goal Directedness	9		22
Mutuality	11	10	10
Active	6	14	11
Learning Style	10	8	13

Two-way repeated measure analyses were performed on CLQ measures with the efficiency scores. The results are presented in Table 6.37, below. Out of a possible 56 relationships only 2 were found to be significant (past experience with change of formatting and goal orientedness and new formatting). These significant results will be discussed in detail below. All other results were non-significant.

TABLE 6.37

REPEATED MEASURES ANOVA F-RATIOS OF CLQ MEASURES TIMES EFFICIENCY ON EXPERIMENTAL TASKS

	AUTO	PAST	PHYSEN	GOAL	MUTUAL	ACTIVE	LEARN
Location	2.55	.92	.65	.72	.57	.81	.34
Change	.58	1.31	.45	1.20	.61	.63	1.87
Delete	.96	1.33	1.19	.54	.51	.11	.32
Insert	.79	2.16	.36	.32	1.15	1.12	1.50
For Ch	.72	2.59*	.44	.98	.32	.45	.73
For New	.24	1.08	1.31	4.67**	.43	.29	.56
Task	1.97	.90	1.18	.41	.34	1.10	.99
Total	1.39	1.34	.41	.84	.42	.38	.87

* p <.05; ** p<.01; *** p<.001

Examination of the past experience by change in formatting result show that Hotelling's $T^2 = .31$, ns. Therefore, there are no significant differences in groups across the experimental sessions. The means are presented in the table below and suggest that secretaries with medium or high past experience scores dip at session 3 but rise again on the final session whereas the mean scores of low past experience people steadily drop through the 3 sessions.

TABLE 6.38

MEANS FOR PAST EXPERIENCE BY CHANGE IN FORMATTING

	LOW	MED	HIGH
Session 1	3.75	3.21	3.00
Session 3	3.17	2.56	1.88
Session 4	1.88	2.87	2.62

For the goal orientedness and new formatting Hotelling's T^2 was equal to .21 (ns). The means show that both high and low groups have fairly consistent mean scores except at session 2 (see Table 6.39, below).

TABLE 6.39

MEANS FOR GOAL ORIENTEDNESS BY NEW FORMATTING

	LOW	HIGH
Session 1	1.11	1.29
Session 2	5.00	3.82
Session 3	1.00	1.09
Session 4	1.01	1.08

DISCUSSION

Results of the 2-way MANOVAs do not support the research hypotheses being tested. These results suggest that the EPQ, ALQ, CLQ and most measures on the ECQ are not systematically related to secretaries' learning Word 5. Systematic differences in efficient performance for age were not anticipated. The results support the hypothesis that there are no age differences in learning to use a word processing system. However, there were significant differences in the effective use of new formatting procedures with all 3 groupings of age. The results suggest that the age difference in formatting is due to the behavior of 36-45 year-olds. It was suggested that this group may include women returning to work and who feel overwhelmed by the formatting options available to them now that were not available when they left work. Another type of explanation might be that these women are at a critical stage in their careers and may feel more pressure to produce high quality documents. This pressure could lead them to use menu driven procedures they know rather than faster short-cut methods.

Because the age range in this study was continuous from less than 20 to 60 years of age, these results may be more valid than those of the Elias, et al. (1987) study which also found no differences in the ability to learn a word processing system. In the Elias study there were three age groups, but large gaps between ages. This might have exacerbated any differences between groups.

It was expected that previous computing experience would affect efficient use of Word 5. Rosson (1985) concluded that practice and experience alone do not encourage the use of efficient editing methods but her study focused on everyday editing use and not on the learning of a word processing system. However, she does suggest that job function and use of other editing systems were the best predictors of efficient editing methods. In the present study all subjects were secretaries so differences in job functions were seen to be too subtle to measure. The previous experience variable may have confounded both the length of previous computing experience and use of different word processing systems because most secretaries with experience of other word processing systems are also the secretaries with large amounts of previous experience with other computer applications.

It will be reassuring to University officials that the type of office and number of people in an office do not affect the learning of word processing skills. However, the writer is sure that the secretaries involved in this study perceive that working in hectic offices surrounded by noise and people was not conducive to learning. Clearly, one factor not assessed, but relevant to this discussion, is the level of concentration which secretaries gave to the learning of word processing skills. Some external distractions may encourage individuals to concentrate more and 'white out' the distractions. These people would be likely to be able to continue learning. The learning by individuals more easily distracted might have been adversely affected.

The results of the EPQ and ALQ will be discussed together because of the overlap in variables measured. It was hypothesized that individuals with high levels of trait or state anxiety would exhibit less efficient use of editing methods. The results do not support this hypothesis; in this study there were no significant differences in efficiency and trait and state anxiety (as measured on the ALQ) or neuroticism (as measured on the EPQ). This suggests that anxiety, as measured in this study, does not affect the learning of word processing skills. It may be that anxious individuals have already developed compensatory mechanisms for countering their anxious states. Perhaps if task execution time had been measured anxious individuals would have been found to take longer to complete an editing task than non-anxious individuals.

Extraversion and efficiency are also not related which suggests that learning to use a word processing system is not affected by the level of outgoingness of the individual. The numbers of subjects were too small to test whether the medium level extraverts and neurotics performed better than other subjects.

In the previous chapter descriptive results of Deep and Surface levels of processing were presented. Those results indicated that it is possible to form 3 groups of low, medium, and high Deep and Surface processors. However, there are no significant differences in efficiency and levels of processing. It may be that regardless of level of processing, learning at this basic level, occurs. It may be that with skilled users differences between Deep and Surface processors will emerge. On the other hand, studies of approaches to studying have focused on academic studying and not on skill learning. It may be that learning a skill requires an approach to learning quite different from the theoretical continuums described by Entwistle and others (Entwistle, 1981; Marton and Saljo, 1976a; 1976b; Pask, 1976).

In Chapter 3 theories of adult learning were presented in terms of how these theories might be applied to the learning of word processing skills. It was hypothesized that the conditions of learning put forward in those theories should affect the learning of word processing skills. There were no significant differences on any measures of the CLQ and efficiency. There is no evidence that the conditions of adult learning theorized in the literature are necessary for efficient editing functions to be employed at this early stage of learning.

SUMMARY

This chapter explored the evidence for systematic differences in group performance on levels of efficiency in performing editing tasks. The nominal descriptive coding was transformed into an ordinal coding of efficient editing use based on secretarial standards of performance. Levels of efficiency on editing functions were then compared with measures of secretarial characteristics on the ECQ, ALQ, EPQ, and CLQ using 2-way repeated MANOVAs. No systematic differences were found which suggests that the characteristics of learners, as measured in this study, do not affect efficient use of editing functions.

CHAPTER 7

INDIVIDUAL DIFFERENCES

In the previous chapter differences between groups of secretaries' efficieny based on the secretarial model and psychological measures were examined through repeated measures ANOVAs. The result of the efficiency analyses was that all secretaries made similar progress throughout the period of study, regardless of psychological makeup. Though these results are possible they do seem somewhat improbable given the large body of literature which suggests that psychological makeup would effect learning rates and style. It, therefore, seems more likely that measuring efficiency using the secretarial model was not successful in examining individual differences in learning to use a word processing system. An alternative method of considering individual differences will be explored in this chapter.

The original nominal codings provide an extremely detailed account of editing functions used to achieve each editing task. The nominal codings were, therefore, transformed to calculate the number of times each editing function was used throughout the 4 experimental sessions. The COUNT command within SPSS-X calculated the frequency of occurrence of each of the editing functions used by the secretaries. The 3 secretaries each missing a full experimental session were excluded from these analyses because there was no way of estimating the number of times each function was used. This leaves a sample size of 28 for these analyses. Table 7.1 provides information about the items included in these analyses and their frequency of occurrence over all 4 experimental sessions.

TABLE 7.1

FREQUENCY OF OCCURRENCE OF VARIABLES ACROSS ALL EXPERIMENTAL SESSIONS

	Variable	Label	f	%
LOCATION				
	tloc1	Search	142	8.2
	tloc2	Ctrl+Page	196	11.4
	tloc3	Pageup F10	338	19.6
	tloc4	H,E F7/8	239	13.9
	tloc5	Cursor	706	41.0
		TOTAL	**1621**	**94.1**
CHANGE				
	tchan1	Replace	26	3.5
	tchan2	Delete/Insert	31	4.2
	tchan6	Help	27	3.6
	tchan8	Backspace/type	295	39.7
	tchan9	F6+F8 del p ins	29	3.8
	tchan10	F6+F8 del c ins	60	8.1
	tchan12	Overtype	115	15.5
	tchan13	F6+C del/ins	45	6.1
	tchan14	F6+8,10 esc/del	35	4.7
		TOTAL	**663**	**89.2**
INSERT				
	tins1	Type	515	87.8
	tins2	Help	33	5.6
	tins8	Delete/Type	22	3.7
		TOTAL	**570**	**97.1**
DELETE				
	tdel1	highlight/del	11	4.9
	tdel2	Esc/Del	10	4.4
	tdel3	Del/backspace	94	41.6
	tdel7	F6+c/del	23	10.2
	tdel8	Shift F8/del	26	11.5
	tdel9	F6+C esc/del	12	5.3
	tdel10	F6+8/10/del	30	13.3
		TOTAL	**206**	**91.2**

Variable	Label	f	%
NEW FORMATTING			
tforn1	Alt +	173	71.8
tforn2	Esc/f/+	30	12.4
tforn4	Help	15	6.2
tforn10	Tab	15	6.2
	TOTAL	**233**	**96.6**
CHANGE FORMATTING			
tforc1	Alt +	106	27.5
tforc2	Esc/f/+	119	30.8
tforc3	retype	16	4.1
tforc4	Help	44	11.4
tforc8	F6+c/Alt+	13	3.4
tforc12	Esc/f/d/page	40	10.4
tforc14	Several	14	3.6
	TOTAL	**352**	**91.2**

In order to reduce the data to a reasonable size editing functions which were used less than 3.5% of the time were excluded. Such functions would have been used by 1 or 2 individuals once or twice only. Items such as tchan5 (retyping text), tchan11 (F6+c/del retype) tdel4 (overtype) were excluded and are not included in Table 7.1, above.

Mean performance was calculated for each editing function on each of the 4 experimental session. The 4 means were then added together to provide an overall mean score for each individual on each editing function across all experimental sessions. Table 7.2 below, lists the SPSS-X commands used to calculate mean performance. For example, to calculate the overall mean of use of the Arrow keys to locate text the SPSS-X COUNT command calculates the number of times arrows were used for each of the location moves within each experimental session (called loca51 loca52 loca53 and loca54) then the COMPUTE command calculates the mean for each experimental sessions (e.g. LOCA51/10 for the mean of the first experimental session) and finally the 4 means are added together. This value is saved as a new variable called TLOC5.

TABLE 7.2

SPSS-X COMMANDS TO FORMULATE OVERALL MEANS FOR EACH EDITING FUNCTION

```
COUNT LOCA51=LOC11 LOC12 LOC13 LOC15 LOC16 LOC17
 LOC18 LOC19 LOC110 LOC111 (5)
COUNT LOCA52=LOC21 LOC22 LOC23 LOC24 LOC25 LOC26
 LOC27 LOC28 LOC29 LOC210 LOC211 LOC212 (5)
COUNT LOCA53=LOC31 LOC32 LOC33 LOC34 LOC35 LOC36
 LOC37 LOC38 LOC39 LOC310 LOC311 LOC312 LOC313
 LOC314 LOC315 LOC16 LOC317 (5)
COUNT LOCA54=LOC41 LOC42 LOC43 LOC44 LOC45 LOC46
 LOC47 LOC48 LOC49 LOC410 LOC411 LOC412 LOC413
 LOC414 LOC415 LOC16 LOC417 LOC418 LOC419 (5)
COMPUTE TLOC5 = (LOCA51/10) + (LOCA52/12)
 + (LOCA53/17) + (LOCA54/19)
```

Descriptive statistics were produced for each editing function described above (see Table 7.3, below). From the descriptive statistics it was clear that several variables should be exlcuded from further analyses because in many instances over half the sample had never used the function. Thirteen variables were excluded on these grounds. These consist of:

tchan1	tins2	tdel1	tforn3	tforc3
tchan6	tins8	tdel2	tforn10	tforc8
		tdel7		tforc14
		tdel9		

The remaining 22 variables were retained for futher analysis.

TABLE 7.3

DESCRIPTIVE STATISTICS: OVERALL MEAN SCORES OF FREQUENCY

Variable	Label	Mean	SD	Range
LOCATION				
tloc1	Search	.32	.46	0-2.00
tloc2	Ctrl+Page	.46	.28	.1-1.30
tloc3	Pageup F10	.67	.43	0-1.84
tloc4	H,E F7/8	.67	.25	.3-1.28
tloc5	Cursor	1.61	.65	.58-2.91
CHANGE				
tchan1	Replace	.15	.22	0-.75
tchan2	Delete/Insert	.34	.24	0-1.00
tchan6	Help	.20	.27	0-.92
tchan8	Backspace/type	1.35	.60	0-2.29
tchan9	F6+F8 del p ins	.12	.13	0-.38
tchan10	F6+F8 del c ins	.28	.31	0-1.00
tchan12	Overtype	.51	.69	0-2.33
tchan13	F6+C del/ins	.21	.25	0-.83
tchan14	F6+8,10 esc/del	.17	.23	0-.88
INSERT				
tins1	Type	3.43	.37	2.31-3.80
tins2	Help	.22	.16	0-.94
tins8	Delete/Type	.13	.19	0-.75
DELETE				
tdel1	highlight/del	.23	.41	0-1.33
tdel2	Esc/Del	.26	.44	0-1.00
tdel3	Del/backspace	1.44	.48	.83-2.33
tdel7	F6+c/del	.35	.43	0-1.50
tdel8	Shift F8/del	.41	.32	0-1.00
tdel9	F6+C esc/del	.20	.28	0-1.00
tdel10	F6+8/10/del	.43	.52	0-1.83
NEW FORMATTING				
tforn1	Alt +	2.04	.49	1.0-3.0
tforn2	Esc/f/+	.86	.76	0-2.0
tforn4	Help	Dichotomy		
tforn10	Tab	Dichotomy		

Variable	Label	Mean	SD	Range
CHANGE FORMATTING				
tforc1	Alt +	.62	.26	0-1.07
tforc2	Esc/f/+	.96	.45	.25-1.79
tforc3	retype	.24	.34	0-1.0
tforc4	Help	.38	.36	0-1.04
tforc8	F6+c/Alt+	.07	.10	0-.39
tforc12	Esc/f/d/page	.27	.17	0-.64
tforc14	Several	.09	.12	0-.39

PRINCIPAL COMPONENT ANALYSIS

To examine the underlying organization of variables and as a means of reducing the large number of variables to a manageable number, principal component analyses were carried out on the data. The mean frequency scores (described above); ECQ, ALQ, and CLQ variables were all used in principal component analyses.

There were three reasons why principal components analysis was selected. First, one purpose of principal components analysis is exploratory in nature (Child, 1970; Comrey, 1973; Gorsuch, 1974). No assumptions are made about the structure of the data beforehand and the analysis is used as a way to look for an underlying meaningful organization of the data. For the ECQ and the mean frequency scores there were no assumptions made about the data and therefore this analysis is quite appropriate. Second, and in particular for the ALQ and CLQ, it was hoped that the analysis would provide evidence for an underlying latent structure which would indicate the need for further research. Such a structure might produce components which could be interpreted. In this latter instance, principal components, is used to see if the data fit the theoretical structure proposed in the design of the attitude questionnaires (Comrey, 1973; Gorsuch, 1974). Third, assuming interpretable components are produced, factor scores could be included in a cluster analysis to identify groups of secretaries with similar psychological makeups and similar styles of word processing use.

Everitt, (1993) reports on several studies which use factor scores generated from principal component analyses in cluster analyses.

One assumption underlying use of principal component analytic procedures is that the variables must be correlated. Obviously, in order for there to be an underlying structure in a matrix variables must be associated. Inspection of the correlation matrices provides a useful guide to the interpretation of the relationship between variables (cf. Child, 1970). Table 7.4, below, shows the correlations among variables of the ECQ used in the principal component analysis. The highest correlation coefficient is between the type of office secretaries worked in (Typeoff) and the number of people sharing an office (Noffice); r =.67, df=26, p <.01. Not surprisingly, the busy reception offices tended to be the offices with more than one person working. The next highest correlation shows a positive association between Uni (length of employment within the University) and Worker (the secretarial status of the individual); r = .44, df=26, p <.05.

TABLE 7.4

CORRELATION MATRIX: ECQ VARIABLES

	AGE	PREVCOMP	WORKER	UNI	NOFFICE	TYPEOFF	PREVWP
AGE	1.00						
PREVCOMP	-.08	1.00					
WORKER	.12	.10	1.00				
UNI	.27	-.29	.44	1.00			
NOFFICE	-.30	.11	-.46*	-.40*	1.00		
TYPEOFF	-.24	-.04	-.26	-.31	.67**	1.00	
PREVWP	.08	.31	.40*	-.16	.10	.09	1.00
CURWP	-.23	.00	.01	-.16	.23	.14	.20
DIARY	-.12	.18	-.07	-.43*	.25	.43*	.22

	CURWP	DIARY
CURWP	1.00	
DIARY	.21	1.00

* = p < .05
** = p < .01

The correlation matrix for the editing function scores used in the principal components analysis is shown in Table 7.5, below. The highest correlation describes a negative association between using the backspace or delete key and then typing in the correction (tchan8) and using the overtype facility (tchan12). This correlation resulted in r = -.81, df=26, p < .01. There are other high correlations in this matrix including : a negative association between use of the F6+arrow keys (tdel7) and the Shift+F8 keys used to extend the cursor (tdel8) before deleting text with the delete key (r = -.54, df=26, p < .01); a positive association between use of the search command (tloc1) and use of the overtype facility (tchan12) (r = .53, df=26, p < .01).

TABLE 7.5

CORRELATION MATRIX: MEAN FREQUENCY OF USE VARIABLES

	TLOC1	TLOC2	TLOC3	TLOC4	TLOC5	TCHAN2	TCHAN8
TLOC1	1.00						
TLOC2	.32	1.00					
TLOC3	-.32	-.37	1.00				
TLOC4	-.43*	.07	.29	1.00			
TLOC5	-.45*	-.44*	-.42*	-.28	1.00		
TCHAN2	-.10	-.20	.22	.03	.06	1.00	
TCHAN8	-.50**	-.01	.20	.21	.23	.37	1.00
TCHAN9	-.08	-.14	.27	.30	-.29	.11	-.24
TCHAN10	-.27	-.11	.00	.48**	.10	.26	.07
TCHAN12	.53**	-.07	-.14	-.49**	-.12	-.42*	-.81**
TCHAN14	.15	.38*	.14	-.01	-.30	-.03	.07
TINS1	.09	.16	.06	.22	-.12	.36	.13
TDEL3	.36	-.13	-.42*	-.26	.22	-.22	-.16
TDEL7	.13	.10	.15	-.07	-.18	.02	-.20
TDEL8	-.12	-.05	.16	.23	-.13	.11	.12
TFORN1	.02	.11	.23	.04	-.30	-.04	.13
TFORN2	-.15	.07	.02	.39*	-.05	.21	.10
TFORC1	-.13	-.08	-.03	.08	-.01	-.08	.28
TFORC2	.19	.32	-.06	.11	-.27	-.13	-.15
TFORC4	-.25	-.24	.08	-.02	.32	.32	.26

	TCHAN9	TCHAN10	TCHAN12	TCHAN14	TINS1	TDEL3	TDEL7
TCHAN9	1.00						
TCHAN10	.30	1.00					
TCHAN12	-.00	-.41*	1.00				
TCHAN14	-.48**	-.34	-.05	1.00			
TINS1	-.28	.33	-.26	.27	1.00		
TDEL3	-.51**	-.13	.29	.02	-.08	1.00	
TDEL7	-.12	-.22	.22	.34	.22	.08	1.00
TDEL8	.38*	.25	-.21	-.11	-.03	-.26	-.54**
TFORN1	.34	-.04	-.21	-.22	-.19	-.16	-.12
TFORN2	-.19	.47*	-.27	.32	.45*	.03	.03
TFORC1	.00	-.03	-.16	-.39*	-.22	.09	-.11
TFORC2	-.07	-.05	.01	.47*	.18	.13	.15
TFORC4	.14	.12	-.18	-.35	-.11	-.12	-.20

	TDEL8	TFORN1	TFORN2	TFORC1	TFORC2	TFORC4
DEL8	1.00					
FORN1	.14	1.00				
FORN2	.15	-.38*	1.00			
FORC1	.18	.09	-.08	1.00		
FORC2	.07	-.21	.35	-.42*	1.00	
FORC4	.10	.18	-.39*	-.01	-.60**	1.00

* = $p < .05$
** = $p < .01$

Within the ALQ correlation matrix the highest association is positive and between the statements "I generally put a lot of effort into trying to understand things that initially seem difficult" (deep2) and "I find I have to concentrate on memorizing a good deal of what I to learn" (surf1); $r = .73$, $df=26$, $p < .05$ (see Table 7.6, below). The next highest correlation is between the two statements concerned with state anxiety. They have a correlation of .64 ($df=26$, $p < .01$). Two of the statements about a surface approach to learning produced a high negative correlation. Surf3 ("I try to memorize important facts which may come in useful later") and surf5 ("Often I have to read instructions without really being able to understand them") had a correlation of -.61 ($df=26$, $p < .05$).

TABLE 7.6

CORRELATION MATRIX: ALQ VARIABLES

	DEEP1	SURF1	DEEP2	TRAIT1	SURF2	DEEP3	STATE1
DEEP1	1.00						
SURF1	-.03	1.00					
DEEP2	.04	.73**	1.00				
TRAIT1	.08	.10	-.07	1.00			
SURF2	-.02	.07	-.04	.33	1.00		
DEEP3	.42*	-.22	.09	.06	.06	1.00	
STATE1	.10	-.21	-.18	.00	-.13	.27	1.00
EXT1	.01	-.44*	-.41*	-.07	-.06	.32	.12
DEEP4	.27	-.12	.09	.02	-.43*	.40*	.39*
SURF3	.12	.35	.40*	-.28	.02	.04	-.01
SURF4	-.34	-.17	-.50**	-.03	-.06	-.35	.24
DEEP5	.20	.29	.32	.29	-.05	.02	.45
TRAIT2	.18	.14	.06	.40*	.06	-.20	-.18
SURF5	-.11	-.15	-.32	.24	-.01	-.28	.05
STATE2	.04	-.05	-.03	.06	-.13	-.07	.64**

	EXT1	DEEP4	SURF3	SURF4	DEEP5	TRAIT2	SURF5	STATE2
EXT1	1.00							
DEEP4	.34	1.00						
SURF3	-.12	.29	1.00					
SURF4	.06	-.16	-.18	1.00				
DEEP5	-.19	.25	.04	.01	1.00			
TRAIT2	-.23	-.31	-.28	.07	.23	1.00		
SURF5	.13	-.12	-.61**	.27	.06	.29	1.00	
STATE2	-.07	.27	-.14	.25	.51**	-.05	.35	1.00

* = $p < .05$
** = $p < .01$

The highest correlation from the CLQ was between the two statements concerned with an active approach to learning ("I'd rather turn on the computer and 'have a go' than wait for someone to show me how" and "I never feel nervous about trying out new things"). Active1 and active2 were correlated at .47 (df=26, $p < .05$). The full correlation matrix for the CLQ is shown in Table 7.7, below. The other highest correlation was negative and between past1 ("Nothing I have learned before is helping me master this computer") and mutual2 ("When I feel overwhelmed by the job there is no one in authority who helps me") ($r = -.44$, df=26, $p < .05$).

TABLE 7.7

CORRELATION MATRIX: CLQ VARIABLES

	AUTO1	PAST1	PHYS1	AUTO2	GOAL1	MUTUAL1	ACTIVE1
AUTO1	1.00						
PAST1	.32	1.00					
PHYS1	-.18	.28	1.00				
AUTO2	.22	.41*	.23	1.00			
GOAL1	.02	.13	.05	.31	1.00		
MUTUAL1	-.35	.01	-.07	.13	.02	1.00	
ACTIVE1	-.03	-.02	.17	.24	.39*	-.02	1.00
LEARN1	.31	.17	-.31	.11	-.18	-.06	-.07
LEARN2	-.25	.19	.05	.30	.16	.26	.36
ACTIVE2	-.10	-.06	-.03	.08	.26	-.25	.47*
MUTUAL2	-.13	-.44*	-.30	-.11	-.01	.33	.21
PAST2	.19	-.14	-.27	-.28	.13	.07	-.10
GOAL2	-.09	.12	.12	.20	.41*	-.22	.02

	LEARN1	LEARN2	ACTIVE2	MUTUAL2	PAST2	GOAL2
LEARN1	1.00					
LEARN2	.16	1.00				
ACTIVE2	-.18	.06	1.00			
MUTUAL2	.04	.31	.06	1.00		
PAST2	-.03	-.29	-.05	.19	1.00	
GOAL2	-.09	.24	-.07	.02	.18	1.00

* = $p < .05$
** = $p < .01$

As can be seen from the Tables above, correlation coefficients show a considerable range within each correlation matrix.

The default commands of the FACTOR program within SPSS-X were used to generate the principal components analysis and resulting factor scores. This analysis produces an unrotated factor matrix and the matrix was subsequently rotated using the Varimax procedure. Factors with eigenvalues greater than 1 were selected for examination.

Principal components are often not interpreted (Gorsuch, 1973; Stevens, 1992). However, these same authors suggest that it is permissible to attempt interpretations. Given the nature of the variables included in this study it seems appropriate at least to describe what each factor most likely represents. The decision was made to interpret the rotated factor matrix because in most instances the factors loaded on fewer variables and therefore were slightly easier to discuss. It must be stated, however, that the unrotated factors would have provided perhaps a more fuller description of the original data.

PRINCIPAL COMPONENTS ANALYSIS: MEAN FREQUENCY SCORES

As stated previously, it was initially necessary to reduce the number of variables included in the mean frequency scores for editing functions because several variables did not meet the necessary assumptions of the Principal Component Analyses. Variables which accounted for less than 3.5% of total use were excluded from these analyses. From this pool of 23 variables 2 variables (TCHAN13: F6C d/i; TDEL10:F6+8 del) were excluded because they only correlated with each other. Finally, a further variable (TFORC12: page formatting) had to be excluded because it interfered with the correct running of the procedure (its inclusion produced an ill-conditioned matrix) indicating that the low correlations between this variable and all others produced a correlation matrix which could not be analyzed.

The final variables included in the analysis come from all 6 types of editing function. The variables are listed in Table 7.8 below along with the final communality values and Eigenvalues for the final 8 extracted factors.

TABLE 7.8

PRINCIPAL COMPONENT ANALYSIS OF MEAN FREQUNECY SCORES: COMMUNALITIES, EIGENVALUES, PERCENTAGE OF VARIANCE

VARIABLE	COMMUNALITY	*	FACTOR	EIGENVALUE	PCT VAR	CUM PCT
TLOC1	.92479	*	1	3.94279	19.7	19.7
TLOC2	.87658	*	2	3.16528	15.8	35.5
TLOC3	.91295	*	3	2.44037	12.2	47.7
TLOC4	.77367	*	4	1.78267	8.9	56.7
TLOC5	.93576	*	5	1.59929	8.0	64.7
TCHAN2	.79285	*	6	1.33018	6.7	71.3
TCHAN8	.90244	*	7	1.15932	5.8	77.1
TCHAN9	.86571	*	8	1.04091	5.2	82.3
TCHAN10	.85504	*				
TCHAN12	.89805	*				
TCHAN14	.86482	*				
TINS1	.74842	*				
TDEL3	.63314	*				
TDEL7	.80712	*				
TDEL8	.83798	*				
TFORN1	.63377	*				
TFORN2	.82975	*				
TFORC1	.90297	*				
TFORC2	.74249	*				
TFORC4	.72251	*				

A sample size of 28 and variables of 20 is far too small to run a definitive principal components analysis. Therefore, the interpretation of these results must be taken with extreme caution. The mean communality is .82304, well above the criterion of .70 suggested by Stevens (1992). The resulting 8 factors account for 82.3% of the variance. To explore the results factor loadings were examined. Loadings equal to or greater than .4 were considered.

Interpretation of the 8 resulting factors is difficult. Some variables, such as TLOC5, TCHAN9 and TCHAN14, load significantly on more than one factor (see Table 7.9 below). However, it is possible to describe what each factor appears to represent. Factor 1 describes using the menu system to accomplish changes in formatting and moving text by contrast with use of shortcut keys (TFORN1) or requesting help (TFORC4). Once the menu system is entered the user is prompted (or guided) through the change.

TABLE 7.9

MEAN FREQUENCY VARIABLES OF EDITING FUNCTIONS FACTOR LOADINGS FOR P.C. ANALYSIS VARIMAX ROTATION

	F1	F2	F3	F4	F5	F6	F7	F8
TFORC4	-.76584							
TFORC2	.74732							
TFORN2	.68309		.39238	.38121				
TCHAN14	.64873		-.45852					
TCHAN8		.88012						
TCHAN12		-.83660						
TLOC1		-.74160		.43224				
TLOC3			.88424					
TLOC5			-.62010		-.56723			
TDEL3			-.60295					
TCHAN9			.56728	.49498				
TCHAN10				.83537				
TLOC4				.65993				
TLOC2					.87860			
TFORN1	-.44437				.48413			
TCHAN2						.79654		
TINS1						.73912		
TDEL8							.85609	
TDEL7							-.83440	
TFORC1								.91058

Factor 2 is quite different and describes single key presses used to change text. In other words, the delete key is used on its own to delete a string of text; the cursor key is used, on its own, to locate text. There are negative loadings on using the search command and overtype facilities both of which would be opposites of single key presses. Factor 3 describes use of the Pageup, pagedown keys both to locate text and used in conjunction of moving text.

Factor 4 describes use of the specialist function keys to locate and to change text. This would include the keys across the top of a keyboard, as well as the home pageup keys and use of the ALT and CTRL keys. Factor 5 describes the fast shortcuts used to produce titles. This includes using CTRL plus pageup to get to the top of a document and use of the ALT and CTRL keys to format the title into bold, capitals and centred. The following factors must be considered as even more tentative than the previous ones due to their very low eigenvalues. Factor 6 is not at all clear but combines use of the del and ins keys to move text and typing in new text. Both actions involve single key presses. Factor 7 describes actions involving whole sentences and focuses on use of SHIFT + F8 to highlight a sentence to either delete it or move it. Factor 8 describes use of the ALT key to change formatting. This is a different use from using the ALT key to format titles. The former is used to change from one format to another; the latter is used to introduce a format to previously unformatted text.

PRINCIPAL COMPONENTS ANALYSIS: ECQ

The principal components analysis with ECQ variables was difficult to carry out because so many ECQ variables were nominal in measurement. For the purposes of this analysis, continuous and ordinal variables were included. Overall the 3 extracted factors account for only 61.7% of the variance and the mean communality is only .6165. Table 7.10 below shows the summary statistical results for this analysis. The communality for Age is very low (.31) which may suggest the undesirablity of using an ordinal measure for age. The communality for Diary is also low (.47).

TABLE 7.10

PRINCIPAL COMPONENT ANALYSIS OF ECQ: COMMUNALITIES, EIGENVALUES, PERCENTAGE OF VARIANCE

VARIABLE	COMMUNALITY	*	FACTOR	EIGENVALUE	PCT VAR	CUM PCT
AGE	.30846	*	1	2.78399	30.9	30.9
PREVCOMP	.67612	*	2	1.67775	18.6	49.6
WORKER	.80063	*	3	1.08700	12.1	61.7
UNI	.69237	*				
NOFFICE	.67887	*				
TYPEOFF	.59933	*				
PREVWP	.71834	*				
CURWP	.60886	*				
DIARY	.46577	*				

The rotation, using the Varimax procedure, converged in 8 iterations. The first extracted factor describes younger secretaries new to the university, who work in shared offices and are experienced with using one of the Microsoft Word packages (see Table 7.11 below). Factor 2 describes computer experienced secretaries newly appointed to the University. This experience is with both word processing packages and other types of computer use, such as database and spreadsheet use. Factor 3 describes Senior University secretaries who are experienced word processing users.

TABLE 7.11

ECQ FACTOR LOADINGS FOR P.C. ANALYSIS VARIMAX ROTATION

	FACTOR 1	FACTOR 2	FACTOR 3
NOFFICE	.73572		
CURWP	.62764		.45036
AGE	-.55261		
PREVCOMP		.80017	
UNI	-.40847	-.65472	
DIARY	.46171	.49169	
WORKER			.83133
PREVWP		.50046	.67642

PRINCIPAL COMPONENTS ANALYSIS: ALQ

The ALQ was designed to test hypotheses that the attitude statements used in the questionnaire would tap individuals' level of deep and surface styles of learning, trait and state anxiety, internal and external motivation. It is clear that these constructs did not form totally distinct factors as might have been expected. Rather the factors show some overlap between constructs. For the purpose of this analysis - to enter factor scores into a cluster analysis - this is permissible.

In the initial analyses presented in Chapter 5 the variables associated with internal motivation were excluded. Due to the lack of variance these were excluded here as well. In addition one of the variables associated with external motivation had to be excluded because it correlated with only one other variable in the analysis. The remaining 15 variables formed 5 factors accounting for 72.0% of the total variance. The mean communality was .771 (see Table 7.12 below).

TABLE 7.12

PRINCIPAL COMPONENT ANALYSIS OF ALQ: COMMUNALITIES, EIGENVALUES, PERCENTAGE OF VARIANCE

VARIABLE	COMMUNALITY	*	FACTOR	EIGENVALUE	PCT VAR	CUM PCT
DEEP1	.56684	*	1	2.89777	19.3	19.3
SURF1	.74950	*	2	2.67027	17.8	37.1
DEEP2	.80966	*	3	2.34821	15.7	52.8
TRAIT1	.64545	*	4	1.75420	11.7	64.5
SURF2	.88581	*	5	1.12535	7.5	72.0
DEEP3	.74926	*				
STATE1	.81586	*				
EXT1	.57339	*				
DEEP4	.74432	*				
SURF3	.69136	*				
SURF4	.64654	*				
DEEP5	.77289	*				
TRAIT2	.68156	*				
SURF5	.68270	*				
STATE2	.78066	*				

After a varimax rotation the matrix converged after 7 iterations. The resulting 5 factors show an overlap of variables from the different constructs (see Table 7.13, below). The full statements associated with each variable are presented in Appendix 3. Factor 1 seems to be about putting effort into whatever job is at hand: concentrating on memorizing; put a lot of effort into understanding; questioning things I read. Factor 2 is most concerned with anxiety towards computers and questioning oneself about things. Factor 3 is a more general anxiety factor associated with pressure at work. Factor 4 is associated to a deep approach to learning. Factor 5 is about having to memorize technical jargon and feeling pressured.

TABLE 7.13

ALQ FACTOR LOADINGS FOR P.C. ANALYSIS VARIMAX ROTATION

	FACTOR 1	FACTOR 2	FACTOR 3	FACTOR 4	FACTOR 5
SURF1	.86198				
DEEP2	.82272				
EXT1	-.70755				
STATE1		.85997			
STATE2		.85533			
DEEP5	.43191	.71323			
TRAIT2			.76034		
SURF3			-.72600		
SURF5			.72562		
TRAIT1			.52882		.51559
DEEP3				.75349	
DEEP1				.73590	
SURF4				-.67356	
DEEP4	.44602			.51753	-.43436
SURF2					.93349

PRINCIPAL COMPONENTS ANALYSIS: CLQ

As with the ALQ the CLQ was designed to test theoretical constructs hypothesized for adult learners. Originally there were 14 variables used to describe these constructs. One variable, PHYS2, had to be excluded from the present analyses because it only correlated with one other variable. The remaining 13 variables were entered into the principal components analysis. The analysis resulted in 5 factors being extracted accounting for 70.3% of the total variance. The mean communality was .703. Table 7.14, below shows the communalities, eigenvalues and percentage of variance for each factor.

TABLE 7.14

PRINCIPAL COMPONENT ANALYSIS OF CLQ: COMMUNALITIES, EIGENVALUES, PERCENTAGE OF VARIANCE

VARIABLE	COMMUNALITY	*	FACTOR	EIGENVALUE	PCT VAR	CUM PCT
AUTO1	.76335	*	1	2.42959	18.7	18.7
PAST1	.68998	*	2	2.08445	16.0	34.7
PHYS1	.67297	*	3	1.66166	12.8	47.5
AUTO2	.64721	*	4	1.60685	12.4	59.9
GOAL1	.69150	*	5	1.35650	10.4	70.3
MUTUAL1	.63806	*				
ACTIVE1	.72981	*				
LEARN1	.68725	*				
LEARN2	.72809	*				
ACTIVE2	.75221	*				
MUTUAL2	.73710	*				
PAST2	.71033	*				
GOAL2	.69120	*				

The varimax rotation converged in 10 iterations, resulting in 5 factors. Appendix 4 contains a full list of the statements used in the CLQ associated with the variables described here. Factor 1 describes jumping into new learning experiences. Factor 2 describes a common situation of people muddling through learning experiences and not feeling much support from superiors. Factor 3 is associated with an active style of learning. Factor 4 is a mixed factor but seems to describe a sense of busy self-reliant attitudes. Factor 5 is associated to goal oriented approach to learning to use of computers using the typewriter as the model.

TABLE 7.15

CLQ FACTOR LOADINGS FOR P.C. ANALYSIS VARIMAX ROTATION

	FACTOR 1	FACTOR 2	FACTOR 3	FACTOR 4	FACTOR 5
PAST1	.78580				
AUTO2	.71261				
MUTUAL1		.74924			
LEARN2		.72228			
MUTUAL2	-.49595	.63248			
ACTIVE2			.83854		
ACTIVE1			.81638		
LEARN1				.76726	
AUTO1		-.46841		.70158	
PHYS1	.52236			-.62063	
GOAL2					.80221
GOAL1			.40115		.70742
PAST2	-.52950				.55975

PRINCIPAL COMPONENTS SUMMARY

The 4 analyses reported above produced a total of 21 factors. These analyses were carried out as a way of reducing the number of variables to incorporate into a cluster analysis. As such they do not meet the usual criteria for principal components analyses and must be treated with extreme caution. The principal component analysis with ECQ variables is the weakest of the 4 analyses. With hindsight the ECQ could be improved by ensuring the questions were asked which would have resulted in more continuous measures or in variables that would form dichotomies. It clearly would have helped to ensure that all subjects provided more accurate estimates of practice time on the diaries.

Though these analyses were carried out to produce factors to be used as a guide in the cluster analysis to be described below, they also provided interesting insights into the data. Perhaps the most interesting is to have these different elements come together in one picture, rather than the piecemeal fashion which most statistical analyses highlight. The mean frequency score factors describe different methods of using Word 5: concentrating on the menu system of factor 1 or basing use on the function keys which are associated to factors 3,4 and 5. Factor 2, describes a style of learning based on the QWERTY keyboard. In other words, no shortcuts and every action is directly associated with one press of a key. The factors from the ECQ describe different kinds of secretarial experience with computers. Factor 1 describes young wp experienced people while factor 2 describes people with lots of general and wp computer experience. Factors resulting from the ALQ variables suggest a first factor of working hard and concentrating on the task at hand; while factor 2 is concerned with anxiety towards computers or within oneself. Factor 3 suggests a sense of feeling pressure at work and factor 4 loads on most of the deep processing variables suggesting a deep approach to learning. The final factor seems to be a composite between using memorization as a way of coping with pressure. The factors from the CLQ do not converge easily into the conditions for learning described in Chapter 3. Factor 1 suggests a high level of autonomy as people jump into new learning stiuations. Factor 2 reflects a sense of everyone in the same boat and muddling through. Factors 3 and 4 reflect complementary situations. Factor 3 loads highly on an active learning style while facotr 4 loads on variables associated with self-reliance. The final factor described people who are clear of their goals in learning to use a word processing system.

If the factors tentatively identified in the four analyses were confirmed among much larger samples of subjects learning to use a word processing system, they might be of considerable theoretical and practical importance in training and in the adaptation of tasks to differences among learners. Surprisingly, the variables from the CLQ failed to cohere into clear factors given the degree of certitude exhibited by Knowles (1984) as to the optimal conditions for adult learning. A number of possible explanations could be offered for this finding, but, from the point of view of the University who provide the conditions for learning and practice, it is reassuring that learning takes place in environments which are varied and lacking structure.

The results of the first analysis, however, are inconsistent with the view that learning to use Word 5 can be thought of as the mastery of coherent sets of related functions and not as the accommodation of unrelated operations. Tentatively, this might be taken to offer greater support for a theory of learning based on the acquisition of structured wholes (e.g., by Piaget) than one based on the acquisition of stimulus-response bonds (e.g., by Skinner). The results of the analysis of the ECQ suggest that the secretaries in the sample can be classified in a straightforward manner with reference to age and length and type of experience; though in the absence of a demonstrated link between these groupings and efficiency as measured, the significance of this conclusion seems limited. Just how secretaries approach the task of learning is clarified in the cluster analysis (reported below) but the preliminary results of the factor analysis of the ALQ seem to have separated a factor of general anxiety from one of anxiety specific to computers. The presence of a 'jargon factor' is also of interest to those who have argued that technical language can be a deterrent for people who do not grasp the scientific approach.

CLUSTER ANALYSIS

Cluster analysis is a statistical procedure which groups individual cases in terms of their responses across many variables. It is a technique useful in identifying clusters of individuals who score similarly across many items.

> ...the main concern [of cluster analysis] is with classifying previously unclassified material, i.e., at the start of the investigation the number and composition of the classes is unknown. It is this differentiates clustering as a technique for the analysis of multivariate data from discrimination and assignment methods, where groups are known a priori. (Everitt, 1993, p. 5)

One difference between factor analysis and cluster is that the former groups variables in terms of themselves; and in the latter groups variables in terms of cases.

Cluster analysis follows a series of stages from choosing variables, similarity method and clustering technique before deciding on which combinations produce the most useful cluster solution.

> It is generally impossible a priori to anticipate what combination of variables, similarity measures and clustering techniques are likely to lead to interesting and informative classifications. Consequently, the analysis proceeds through a series of several stages with the researcher intervening if necessary to alter variables, choose a different similarity measure, concentrate on a particular sub-set of individuals, etc. (Everitt, 1993, p. 141)

Distance Measures

The choice of what type of distance measure to use is between a proximity matrix on the similarity of variables or a proximity matrix based on dissimilarity. Everitt (1993) discusses several alternatives. Similarity measures are based on a measure of symmetry and seem to be most useful with binary data. The use of non-binary factor scores do not make a similarity measure useful. Among the dissimilarity measures the Euclidian distance measure is the most common. This is most useful when the data have been transformed from raw scores into some sort of standardized scores. Factor scores meet this criterion and so make the Euclidian measure viable. Another form of dissimilarity measure is called the City Block method. At times the Euclidian and City Block methods cluster variables into a similar format, but at other times there are striking differences. It is appropriate, in the present analysis, to use both Euclidian and City Block measures, in the first instance, before deciding which produces the most useful cluster solution.

Clustering Techniques

For the present study only hierarchical agglomerative methods will be explored. These are methods which begin with each individual forming single clusters and merging individuals, step by step, until all individuals form a single cluster. Several methods are inappropriate for the type of data to be used. These include the single linkage and the complete linkage; both of which are based on the distance between pairs. In the single linkage the minimum distances between pairs is calculated and clusters formed. In the complete linkage the maximum distances between pairs is calculated and the least distant variables are merged. These methods seem to work best with binary, or raw scores, and so would not be suitable here. A technique based on the median is a possibility but Everitt (1993) reports on work by Lance and Williams (1967) which indicates that when the median method is employed on correlation coefficients, or similar measures, interpretation loses its geometrical sense which means that it would extremely difficult to employ this method and make any sense of the result. A clustering method based on the group average is a possibility in the present study. Here the distance between clusters is taken to be the mean of distances between all pairs of individuals. The centroid clustering technique is used with interval scale measures and the distance is calculated as the distance between the mean vectors. The Ward clustering technique was developed to minimize the loss associated with each grouping of individuals.

> "At each step...union of every possible pair of clusters is considered and the two clusters whose fusion results in the minimum increase in 'information loss' are combined." (Everitt, 1993, p 65)

CLUSTER ANALYSIS PROCEDURE

Factor scores from the above reported principal component analyses were included in a cluster analysis along with some measures from the EPQ.

Missing values can cause considerable difficulty in cluster analytic techniques. The difficulty arises in that for many multivariate techniques a group mean is inserted in place of missing data. In a cluster analysis this is inappropriate because the appropriate mean to use is for the individual's particular cluster grouping and the cluster membership is a result of the analysis and cannot be predetermined! For the present analysis the 3 individuals missing a complete experimental session are already excluded from this analysis. The use of factor scores eliminates any further type of missing data.

Given the exploratory nature of cluster analysis three distance measures were used combined with 2 hierarchical methods. The squared Euclidian distance measure and the city block distance measure were used with 3 different clustering techniques: group average, centroid, and Ward's.

Scores from 21 factors and scores from the Neuroticism and Extraversion EPQ measures were used in the present analyses with 28 subjects.

The CLUSTER program within SPSS-X was used to carry out the cluster analyses. Though a total of 6 cluster solutions were produced 4 were uninterpretable. These were produced using the city block method with the centroid and group average technique and the square Euclidian measure used with centroid and Ward technique. The remaining 2 solutions: Squared Euclidian with group average and city block with Ward's resulted in identical cluster memberships of 3 groups.

CLUSTER RESULTS

The cluster program produces dendrograms for as many clusters as desired up to a maximum of the number of cases. The program was asked to produce cluster solutions of 1 to 5 clusters. The dendrograms reproduced below show the cluster formation for the 28 subjects (see Figures 7.1 and 7.2, below).

As mentioned previously, the 2 programs produced clusters with identical memberships, though the route to this differs according to the methods used. This can be seen by comparing the dendrograms. The 3 group solution resulted in clusters of 11, 9 and 8 subjects. In Figure 7.1 the split between groups 1 and 2 occurs between cases 1 and 2. The split between groups 2 and 3 occurs between cases 17 and 18. In Figure 7.2 groups 1 and 2 are divided between cases 1 and 17. Cases 28 and 18 form the division between groups 2 and 3. The figures show that the 2 cluster solution consists of merging clusters 1 and 2 to form one large cluster of 20 subjects with the second cluster being composed of the 8 subjects in cluster 3.

FIGURE 7.1

DENDROGRAM FROM SQUARED EUCLIDIAN USING GROUP AVERAGE METHOD

```
      Rescaled Distance Cluster Combine

CASE  0         5         10        15        20        25
 Seq  +---------+---------+---------+---------+---------+

  4   -+-+
  9   -+ |
 27   ---+-+
 14   ---+ +---+
  6   -----+   |
  7   -----+   |
 12   ---------+---+
 22   ---------+   |
  5   ---------+   +-------------+
  3   -------------+             |
  1   -------------+             |
                                 |
  2   -------+---+               |
 11   -------+   |               +---------------------+
 15   ---+       +-----+         |                     |
 20   ---+---+   |     |         |                     |
 21   ---+   +---+     +-+       |                     |
 28   -------+   |     | |       |                     |
 25   -----------+     | +-------+                     |
 23   -----------------+ |                             |
 17   -------------------+                             |
                                                       |
 18   ---+-+                                           |
 19   ---+ +-+                                         |
  8   -----+ |                                         |
 24   -+-+   +---+                                     |
 26   -+ +---+   |                                     |
 16   ---+   |   +-------------------------------------+
 10   -------+   |
 13   -----------+
```

FIGURE 7.2

DENDROGRAM FROM CITY BLOCK USING WARD'S METHOD

```
   Rescaled Distance Cluster Combine

CASE 0         5        10        15        20        25
Seq  +---------+---------+---------+---------+---------+

  4   -+-+
  9   -+ +-----------------+
 27   ---+                 +---+
 12   -------+-------------+   +---+
 14   -------+                 |   +-------+
  3   -------------------------+   |       |
  6   ---+-------------------------+       +-----+
  7   ---+                                 |     |
  5   ---------------+-----------+         |     |
 22   ---------------+           +---------+     +-----+
  1   ---------------------------+               |     |
                                                 |     |
 17   -----------------------+---------------+   |     |
 23   -----------------------+               +---+     |
  2   -------------+-------------------+     |         |
 11   -------------+                   +-----+         |
 21   ---------+---------------+       |               |
 25   ---------+               +-------+               |
 15   -----+-------+           |                       |
 20   -----+       +-----------+                       |
 28   -------------+                                   |
                                                       |
 18   -----+-----------+                               |
 19   -----+           +-------------+                 |
 10   -----------------+             |                 |
 24   -+-------+                     +-----------------+
 26   -+       +---------+           |
 16   ---------+         +-----------+
  8   -----------+-------+
 13   -----------+
```

ANALYSES WITH CLUSTERS

Having formed 3 groups through the use of factor scores and EPQ measures it is appropriate to attempt to describe group membership and explore the relationship between clusters. One-way ANOVAs were computed for the principal component factors and EPQ measures used in the Cluster Analysis and the 3 cluster groups. Of the 23 factors or variables entered into the cluster analysis there are only 3 significant differences between groups.

There are significant differences on the EPQ neuroticism measure ($F=121.48$, $df=2,25$, $p<.001$). The Scheffe post hoc test showed there are significant differences between all pairs groups. The means for the 3 groups are 10.91, 17.33 and 3.75, respectively, which indicates that Group 2 has a high level of neuroticism, while Group 3 shows a high level of stability; Group 1 is in the mid-range.

The other significant differences are in 2 of the factors of mean frequency variables of editing functions. Factor 4 (use of specialist function keys to locate and change text) produced an $F=4.02$ ($p<.05$, $df=2,25$). The means of the 3 groups are .58, -.20 and -.56, respectfully. The Scheffe test showed the significant difference to be between groups 1 and 3; Group 1 being the large contributors to the this factor and Group 3 providing negative input to it.

Factor 7 which is associated with whole sentence manipulations was also significantly different with the cluster groupings ($F=4.49$, $df=2,25$, $p<.05$). Here the means of the 3 groups are as follows: .09, .55 and -.74. The Scheffe test found a significant difference between groups 2 and 3. The pattern of significant differences for the Scheffe tests are reproduced in the table below.

TABLE 7.16

SUMMARY OF SCHEFFE COMPARISONS

	GROUPS		
	1-2	2-3	1-3
NEUROTICISM	*	*	*
FACTOR 4			*
FACTOR 7		*	

Note: * significant difference $p < .05$

There are several characteristics which seem to define cluster membership. For example, on neuroticism all of the members of the 3rd cluster are low neurotics; the high neurotics are all in cluster 2; and all the medium neurotics are all in cluster 1 (see Table 17, below). Extraversion also shows an interesting distribution across clusters with cluster 1 having a range of levels of extraversion, cluster 2 being mostly medium level extraverts and cluster 3 mostly being high extraverts.

TABLE 17

CHARACTERISTICS OF CLUSTERS

	Cluster Group		
	1 (N=11)	2 (N=9)	3 (N=8)
Neuroticism			
Low	1	0	8
Medium	10	0	0
High	0	9	0
Extraversion			
Low	5	3	2
Medium	3	5	1
High	3	1	5
High Trait/High State	0	2	0
Low Trait/Low State	1	0	3
Yerkes-Dobson Law			
Med Neuro/Med Extra	3	0	0
High Deep/Low-Med Surface	4	3	3
High Surface/Low-Med Deep	1	3	3
Age range	31-50	<20-50	>30-60
Length of University employment (new/old)	6/5	7/2	5/3
Previous computing experience (none/some)	1/10	5/4	4/4
Use of specialist keys	high	med	low
Use of recipes	medium	high	none

The Yerkes-Dobson law, described in Chapter 3, suggested that individuals who were both mid-extraverts and mid-neurotics would be the best learners. These 3 individuals are all in the same cluster: cluster 1.

The ages of the subjects also seem to group according to cluster, as well. The youngest subjects are all in the 2nd cluster and the oldest in the 3rd; there is a mixed middle aged group in cluster 1.

In cluster 1 all but one of the individuals have previous computing experience and these 10 also have previous word processing experience. Clusters 2 and 3 are evenly divided between subjects with no previous computing experience and those with some.

Cluster 2 has a majority of new university employees whereas clusters 1 and 3 have a more even distribution of new and current staff.

The distribution of deep and surface processors is relatively evenly distributed across clusters, though cluster 1 has more individuals with a high deep level of processing than individuals with a high surface level of processing.

A short description of a "typical" member of each cluster may show how the characteristics described above appear in individuals. These descriptions are of actual subjects in the study. Their names have been changed but all other characteristics are unique to the individuals described.

Cluster 1. Mary is currently a senior secretary of a busy Arts department. She has worked within the University for 15 years in several faculties. She has worked on many different computing systems including a BBC-B, Apple Mac, an AEG standalone word processor and she has an Amstrad for use at home. She has used word processing packages on each of the computing systems as well as a database package. The shift to an IBM-PC environment is one which she is overseeing in the department and she is responsible for 3 secretaries making this shift and to transfer data held on other computing systems to a DOS format. She is an extremely conscientious worker who worries, realistically, about the difficulties in her job. During the experimental tasks, Mary asked lots of questions about the best way to carry out editing tasks and in the intervening time between sessions seemed to try out alternative techniques to choose the most appropriate for her needs and herself. When she needed help, with probing, she always came up with a solution but liked to discuss and weigh up different alternatives. My sense was that Mary was a fast learner who works hard to achieve the goals she sets herself.

Cluster 2. Jane is in her mid-thirties and is returning to work after an absence of 7 years while having children. She last worked in the University but feels much has changed both in the duties required of secretaries and the methods used to perform these duties. She works in a noisy office and as the "junior" member has a cramped work area which she must relinquish to academic staff when requested. She was very eager to be a part of this study and also very anxious to please both me and her supervisors. She often asked "Is this right?" or would comment "I'm so slow." She was not confident. She did not seem to remember, from one session to the next, editing procedures she was asked to use. For example on the 3rd experimental session, she vehemently denied ever having swapped text when she had done it the week before; nor did she recall learning about page numbering on the Word 5 course. She wanted to be told how to do something and would stick to one method as a consequence.

Cluster 3. Sue is a new employee of the University but extremely experienced as a secretary in business. She has used computing systems for word processing and database packages and initially resisted having to learn a new word processing package now that she was working in the University. In her mid-forties, Sue appears very calm and capable of handling anything asked of her. Nothing seems to faze her. She shares a tiny office with one other full-time secretary as well as several temporary staff members who perch in a corner. Her chair touches the filing cabinets behind her; any movement within the office must be negotiated between the residents. When the office flooded during a severe storm her response was that these things happen and there's no point in worrying about them; things would take care of themselves. On the EPQ she scored as a high extravert and low neurotic which may explain her tendency to accept the people she works with and the situation she finds herself in. She was the fastest typist of all the subjects and completed the experimental sessions quicker than anyone else, including the time for questions and discussions. Though she understood and could use the extremely sophisticated editing techniques available in Word 5, for the most part, she relied on arrow, pageup, and home keys, to manipulate movements on the screen. She did not like using the function keys.

DISCUSSION

This chapter has explored the evidence for individual differences in stylistic use of editing functions and the personal characteristics of the subjects involved. There is strong evidence for individual differences in cluster membership when a 3 cluster solution is used. However, this evidence must also be considered in view of the sample size and the method for obtaining these results.

The use of principal component analyses in a study of this size can only be seen as exploratory. Its use is justified in an enquiry where no previous models of secretaries learning to use a word processing system exist. For full factorial rigor the number of variables used in these analyses would have legitimately required well over 200 subjects. So the principal component solutions must be considered as being extremely tentative and exploratory.

However, it is extremely interesting that from these tentative and exploratory principal component analyses come an interesting cluster solution which suggests individual differences in stylistic use of Word 5 associated with certain personal and personality characteristics.

This study has been quite different in scope from previous studies of word processing use. The studies, reported in Chapter 1, have looked at word processing use in terms of differences in word processing systems (screen or line-based editors; mouse, joy-stick, or command based systems); differences in training (lecture, video, or manual). None of these studies has focused exclusively on the differences between users and how these differences affect their use of the word processing system.

The results here suggest that differences between users are associated with some differences in use of the word processing system. Anxious individuals tend to use recipe solutions to editing tasks. This implies that such individuals may be able to follow set solutions in manuals but may find it difficult to modify or generalize editing techniques across different demands. They may need help in becoming more flexible in how to use the procedures available. On the other hand, the high extraverts of cluster 3 may need a training schedule which encourages the use of set procedures in order to broaden their use of all the keys and command techniques available within the system.

These extra types of training would probably not be useful or be seen to be helpful to the conscientious, self-learners which characterize cluster 1. These individuals may only need support when they request because they will have already worked out for themselves alternative techniques.

SUMMARY

Counts were made of each editing function and a mean scores of use were derived for each experimental session. These were added together to form an overall mean frequency of use for each editing function.

Principal component analyses were carried out on the mean frequency of use scores, the ECQ, ALQ, and CLQ variables. The resulting factor scores were entered into a cluster analysis along with the EPQ results.

The cluster analysis produced a 3 cluster solution with identifiable characteristics to describe the cluster memberships of each cluster.

These procedures and results were discussed in detail.

CHAPTER 8

DISCUSSION

There is a paradox in the results of this study. In Chapter 6 it was clear that there are no systematic significant relationships between any of the personal characteristics measured and efficient use of editing methods. In Chapter 7, the results of the cluster analysis indicate that there is a relationship between personal characteristics and style of editing use. How can it be that two such different sets of results can appear within one set of data?

The possible reasons for this paradox are many and complex. The most important appear to be: 1) there is the distinction between efficiency and style which could account for two such different sets of results; and 2) there are the limitations and deficiencies in the instruments and procedures used. Each of these will be discussed below.

EFFICIENCY AND STYLE

In this study efficiency was measured in terms of an idealized version of secretarial performance. In other words, efficiency is what a skilled secretary might see as the order of performance of different editing procedures for each of the editing requests required to successfully complete each experimental session. This model of efficiency differs from how efficiency was measured with the skilled users in the Card, et al. (1983) study. In those studies efficiency is equal to speed. Speed, in turn, is often associated to the fewest number of keys pressed. But surely a computer user who attempts to ensure use of the fewest number of keys each time must also expend processing time comparing and evaluating the number of key presses associated with each potential method of editing. One can imagine a long series of production rules in the Anderson (1983) mode to determine the IF THEN sequences required to select the fastest editing procedure for any specific editing task.

Secretaries and other skilled typists often make up for using several key presses by their speed of execution. This may confound the problem of measuring efficiency on the basis of either the number of keys pressed or speed of execution. In either case one would expect a strong correlation between typing speed and efficiency which would imply that poor typists could never be efficient users of word processing systems.

The secretarial model used in this study was not based on the speed of execution or number of key presses. The model was a composite of what secretaries would perceive to be the most economical in time and effort to execute. It is assumed that some description of speed will be a necessary ingredient of efficiency. But in the secretarial model speed can be traded off for a logical set of key presses. For example, in the 2nd experimental session, subjects were required to turn the phrase "often though science" into "science, though often". If the function keys are used to carry out this swap it will take approximately 10 key presses. To retype the phrase will require 21 key presses. However, it is easier to retain the three words in memory and retype them than it is to hold in memory the sequence of editing moves required to swap the text around. This is especially true during the learning phase of using the system when it may be difficult to remember and recall the sequence of editing techniques used to swap text. Therefore, in the model used in this study, judgements were made as to when secretaries would perceive retyping as simpler and therefore easier to carry out rather than using the commands and function keys available in Word 5.

The model used in this study was developed by three judges, two of whom had been secretaries for several years. However, it is likely that three other judges would have developed different hierarchies of preferred use to carry out editing in each of the experimental sessions. This points to both the flexibility of the word processing system which offers many potential methods to reach the same end; as well as the individual differences amongst skilled users who undoubtedly have developed their own unique styles. In one of the studies by Card et al. (1983) their subjects exhibited preferred methods. This is not dissimilar to the stylistic differences found as a result of the cluster analysis in the present study.

Style is different from efficiency though they will overlap. Style is perceived as being a systematic method of being (anxious, extravert, etc.) or doing (always retyping text; using the menu system rather than short cut keys; requesting help rather than discovering for oneself). The personality features suggesting stylistic differences will be apparent once those features are in place. In this study they were presumably evident at the start because they are already well developed entities. Style of using a word processing system is perceived as something which must develop as people become more familiar and knowledgeable about the system they are using. How much exposure to a word processing system is required for stylistic differences in use to emerge is unclear. In this particular study, stylistic differences were emerging within the first month of using Word 5.

But when do style and efficiency become related? In this study there was no evidence of differences in efficiency but there is evidence for differences in style. Is it that the stylistic differences mostly reflect clusters of personal and personality characteristics and so describe the individual differences one would expect to find amongst a group of 28 individuals? Or is it that because these secretaries are still learning how to use the word processing system to carry out their day to day secretarial duties, they have not yet developed a consistent level of efficient performance? This is not to say they will not develop a consistent level of efficient performance, but only that they have not reached that stage after one month of using Word 5. For example, individuals in cluster 1 (described above in Chapter 7) seem to be exploring the system to the best of their abilities in order to work out the best methods for carrying out editing procedures. In this case stylistic characteristics of the individuals may lead them to use editing techniques in an exploratory manner; this could be seen as a stylistic difference since neither of the other clusters exhibit this sort of behavior. However, exploratory methods may not be the most efficient and if this style of use continues then these individuals will retain a style at the expense of efficiency. At some point elements of style and efficiency must merge to balance each other.

As noted previously, this study differs considerably from the studies reviewed in Chapter 1. Those studies did not look at efficiency and style of use. Previous studies of novice word processing users have instead concentrated on two distinct angles: comparing several word processing systems and user characteristics; or training strategies and delivery methods and user characteristics. None of the studies, reported in Chapter 1, has been primarily concerned with the individual differences of the users and how these individual differences affect use of a word processing system. Questions of individual differences in efficiency and style on the basis of user characteristics are of primary interest to those people who have the responsibility for training and supporting users of word processing systems.

TRAINING IMPLICATIONS

As suggested in the discussion of Chapter 7, there may be training implications for individuals showing different styles of use or clusters of personality characteristics. It was suggested that the anxious individuals, defined in cluster 2, would benefit from training to try exploratory editing methods to develop their own unique editing styles; individuals in cluster 3 would benefit from exposure to editing techniques using the function keys to encourage them to use all the keys available. The delivery method of the training course will have implications for how people learn and how much information is retained. This University already operates a separate training program for its secretarial staff. This developed out of the perceived differences in training needs of secretarial versus academic staff. The academic training program assumes limited typing ability and it assumes that staff will wish to fully understand the reasons which underlie various editing techniques. The main focus of the academic course is manipulating text into its correct position. There is little emphasis on all the formatting procedures available to control output. The secretarial courses assume staff will be skilled typists and that they will require a broad range of editing skills, especially formatting, to cover the majority of tasks given them. Courses also differ in their length. The academic course lasts 2 half day sessions whereas the course for secretaries covers 3 half day sessions. The courses on offer, in this University, follow many of the principles of adult learning theories. For example, they assume that people have clear goals in learning to use a word processing system and these courses have developed out of the perceived goals which people have. The courses are divided into small segments so that individuals can work through one bit and go away to try it out in an applied setting (i.e., their own offices with their own work). But it was also common, during the data collection, for some subjects to fail to recall a section of the course and deny knowing about an editing procedure. This happened frequently with the replace command. In the secretarial course this is presented in the first day as it is such a useful and important technique to know. However, no further mention was made of it through the course and it seems as though it was forgotten because of the sheer amount that secretaries were trying to retain from the 3 days. Another reason might be that in the first day's session some secretaries might not have appreciated the relevance of the replace command for their own use.

So there may be elements learned in this study which could be incorporated into word processing courses and so enhance them. A follow-up session with course participants three to six weeks after the original course might pin-point areas where individuals would benefit from additional tuition. Another possibility would be to prepare a series of documents and exercises which reinforces and extends the material covered in the formal course. Sections of the materials could be designed with specific groups of individuals in mind. For example, exercises and review materials geared towards anxious users could encourage users to be more flexible in the techniques used and hopefully gain confidence in using a variety of techniques to perform the same task. Exercises, for members of the 3rd cluster, who, though very quick, tended to be lazy in the range of techniques used, could be designed to encourage understanding of why relying on a few keys is less than good practice in the long run and may result in boredom and fatigue.

These materials could be given to secretaries and used as an additional tool to learning for use in their own offices or the Open Learning Centre at the Computing Service. A further possibility is to incorporate a formal training program which could lead to qualifications in word processing skills at different levels. Programs such as NVQ (National Vocational Qualifications) might be an additional incentive to secretaries to extend their knowledge and abilities.

LIMITATIONS OF THE PRESENT STUDY

The model for the explanation of learning implicitly employed in this study can be represented as a summative model. Variation in learned efficiency was to be explained by the contribution of independent variables drawn from four main categories:

a) Factors common to all types of learning: these included general motivational principles, general anxiety level, personality variables and the so-called optimal conditions for adult learning.

b) Factors specific to word processing tasks: these included specific motivation to learn Word 5, anxiety levels in relation to computers, components of tasks to be acquired and the mental models relevant to them.

c) Factors specific to the sample being studied: these included their previous secretarial experience especially as this related to keyboard skills, age and length of experience, degree of felt autonomy.

d) Individual differences were treated as those factors which constitute the error or unpredicted variance in the explanation of efficiency measures but conceptualized in this study as 'styles'.

In practice, as has been shown, none of the independent variables examined made a substantial prediction (and therefore, constituted a possible explanation) of efficiency variance. This conclusion was maintained where variables were considered for their separate contribution (as in the ANOVA studies, reported in Chapter 6) and, by implication, in the factor analyses. Thus the theoretical structure of this investigation and the conceptual basis of the hypothesized explanation proved inadequate to account for the phenomena of learning observed and the study must be judged deficient in explanatory power. Instead its value lies in a more detailed description of processes than has been supplied by previous studies.

It is conceivable, however, that the underlying conception of how secretaries become differentially efficient in the acquisition of word processing skills is correct but that the enquiry as conducted failed for a number of reasons to provide an adequate basis to test the structure hypothesized. These limitations may lie in the design of the study, the procedures adopted or the instruments. These will each be discussed.

One limitation of the present study was its length. At the time of planning, a four week short-term longitudinal study seemed quite long and sufficient for exploring the stages of learning to use a word processing system. It was assumed that by the end of the study period all the secretaries would be well into an expert stage of use. This was not the case with a large majority of the secretaries. Some were still making the transition from other word processing systems to Word 5, and some of these were quite resistant to the change. Others used the word processing system so little during the gaps between sessions that they were starting fresh each time. A few secretaries were using the system regularly and routinely and they made much progress; but mostly this progress was still to use a limited number of commands and function keys to carry out all their editing requirements. Their use would have to be described as unsophisticated. Had the study carried on for another 2 to 3 months, perhaps with fortnightly visits, more sophisticated and therefore perhaps more efficient use of the word processing system would have been produced. This is not to suggest that the data collected did not yield substantial and interesting results. Rather it is to suggest that with hindsight the study could have been enhanced if secretaries had been followed for longer than a one month period.

One result is very clear from this study. After one month of use most secretaries are still only at a novice stage of unsophisticated use of Word 5 and have not yet developed efficient methods or a consistent style of word processing behavior.

Instruments

As noted throughout, both the ALQ and the CLQ in particular, would have benefited from further development work and more extensive piloting.

While every attempt was made to devise statements as close to the original ones used in Richardson (1979) the results of this study do not produce clear-cut deep and surface processors. This could be due to either the deficiency in the statements used in the present study or to the inappropriateness of using an approach to studying on skill learners.

As in the Richardson (1979) study five statements were devised for each of the deep and surface approaches to studying. However the original Richardson questions had to be modified for use outside of formal education. For example, references to homework, studying, or preparing for exams were inappropriate for this adult sample and had to be changed to statements about the desirability of doing extra reading to fully understand a topic or being able to fulfil duties at work. The number of subjects in the present study was very small and it may have required a much larger sample to throw up more clear cut groupings of individuals. Other dimensions of approaches to studying were not included in this study because of their perceived inappropriateness with the topic being learned and the individuals doing the learning. Had the Richardson instrument been given to the adults in this study it is possible that clearer approaches to learning styles might have been identified.

It may be that it is inappropriate to use an approach to studying on skill learners. There are inherent differences between adolescents learning academic subjects in school and adults learning a cognitive skill outside of formal education. The skill learning required to master a word processing system does seem to follow the skill learning theory defined originally by Fitt's (1963) three stage model: Defining a goal; modifying behavior; fine tuning of behavior.

Acquiring both the knowledge and skills to manipulate that knowledge needed to pass examinations in academic subjects is quite a different matter. So it may be that approaches to studying are limited in scope to formal educational settings of academic subjects.

As far as the writer is aware there have been no empirical studies to test the conditions for learning put forward in adult theories of learning. Though many of these conditions make intuitive sense it would appear that though they may represent an ideal learning situation, this ideal is never met in real-world situations, and certainly not by secretaries learning at the same time as working. But in this study the CLQ failed primarily because it took a too simplistic approach to the theoretical conditions of learning; and two statements per condition did not allow for much variation among subjects.

Piloting

A different sort of problem arose with the pilot group used in this study. Two pilots were carried out, both on very small groups of subjects. In both cases university secretaries not taking part in the study proper agreed to participate in the piloting of the ALQ and CLQ. Unfortunately, all these secretaries were employed within the same department. It may well be that because they work together carrying out similar types of work that they responded in a way which did not provide as useful information as would have been hoped.

Experimental Tasks

The experimental tasks were designed with two goals in mind. First, to ask subjects to carry out editing tasks which would be a normal selection of that asked of secretaries. Second, was to design editing problems whose solutions encompassed many of the specialist techniques taught on the Word 5 course. These included use of the multiple replace command, paginating a document, using running heads, and merging two documents together. Other techniques could have been used, such as tabs and stylesheets, but as many novice word processor users found these concepts difficult it seemed inappropriate at this stage.

Each of the most common editing functions was requested within each experimental task. With hindsight, the study would have been strengthened by the inclusion of identical editing requests across the 4 experimental sessions so that proper comparisons of efficiency could have been possible. The study also would have been strengthened if more editing requirements were requested in each session. This would have ensured that enough components of each editing function type would have been available for statistical analysis.

There is a paradox in the way the data was collected with the offices of each subject and the ensuing variation which occurred to be balanced with the desire to control for as many extraneous influences as possible. There is a trade-off between allowing the naturally occurring variation to be present and to control for variation by carrying out the experimental tasks in the same situation. On the one hand, allowing for variation results in rich data which perhaps, more adequately reflects the state of the individuals. On the other hand, if one location had been used to carry out all experimental sessions any resulting differences between users would have reflected the characteristics of the individual and not external forces. A choice had to be made about the level of variation to allow to occur between subjects and what to control for. It was decided to do the data collection in secretaries' own offices because the interruptions and distractions are the normal state in which these secretaries work and learn to use Word 5. This seemed more important than trying to control for the variation of external influences by using one experimental setting.

Sample

The size of the sample used in this study is small. The statistical analyses used are quite sophisticated and require large randomly selected individuals for proper use. What alternatives were there to analyse the data while investigating individual differences? An obvious solution would have been to extend the number of subjects to make the statistical tests more meaningful. To do so would have been well beyond the scope of this dissertation and would have taken years or vast resources to complete. A non-statistical treatment of the data would have been possible. Case studies could have provided an indepth examination of each subject's level of efficiency and style of use. But it was felt that a qualitative treatment of the data would not have resulted in a study of individual differences

SUGGESTED AREAS FOR FURTHER STUDY

Technological Changes

At the time when this study was being planned Microsoft Word 5.5 was just coming onto the market. The menu system in Word 5.5 is a pull down menu from the top of the screen. This is quite different from the stationary menu on the bottom of the screen used in Word 5. Another difference between the packages is the use of a mouse to move around the screen and invoke editing functions. This is quite different from the menu system of editing techniques in Word 5 which are invoked by pressing keys. It was decided to use Word 5 because most departments had only just made the investment of hardware to support Word 5 and it was felt unlikely that many departments would have the resources to upgrade in order to use Word 5.5. The implication of this was that the subject pool for Word 5 users would remain much greater than the subject pool of Word 5.5 users. This did, in fact, remain the case throughout the period of data collection and still seems the correct decision to have made at the time.

Word 5 and Word 5.5 have been superseded by both Word 6 and by Word for Windows. A study of the same sort carried out today would have to focus on windows software and the use of a mouse and icons. This is very different from the present study.

Issues of efficiency and style would still be relevant within a windows environment though the techniques available to carry out editing procedures will be much more reliant on mouse technology and the ease and ability of users to manipulate the mouse to the correct location.

Two elements of using a mouse which might again promote suggestions of age differences is the necessity of recognizing often very small icons on the screen as meaningful clues to the functions embedded in them. The difficulty is twofold: first, in actually seeing these very small items as meaningful and being recognizable, which may be difficult for people with different levels of visual deterioration; and second, sometimes the icons used do not make sense to the word processor users. For example, one package uses a rubbish bin (called a trash can in the American manual) to refer to the scrap or temporary storage facility. This new jargon is already taxing individuals making the shift from DOS based packages to a windows environment.

A further potential problem is the difficulty many people have of physically moving, or pointing, the mouse to the desired location. This can involve very small wrist or finger movements; it is sometimes difficult to keep the mouse in position while it is also being clicked or double clicked to activate the command. The physical dexterity required to use a mouse may be difficult for anyone with muscular or joint difficulties, something that seems to come with age.

Novice users of windows packages often complain of eye strain because they are not used to spending such concentrated periods of time looking at the screen. This could have repercussions on both the health of users but also individual differences in style of use

The changes being made in the technology will undoubtedly affect how any further research in this area is conducted. But there are other, more substantive, areas of further research which have not been covered in this study and which may be useful to consider individual differences in efficiency and style of word processing use. Previous studies, in this area, have measured execution time for carrying out editing tasks and they have measured error rate. Work in both of these areas could be extended to explore further individual differences in efficiency and style. Other areas of research could also contribute to this area.

The Issue of Speed

Speed of carrying out editing tasks is a common measurement to make. Researchers such as, Card et al. (1983), Gomez et al. (1986) have used execution time as a measure of editing efficiency. These studies did limit subjects to skilled typists. But there can be enormous variation in speed among skilled typists. In the present study, also of skilled typists, speed ranged from 35 to 97 words per minute. Information on execution time should take into account the typing speed of the users involved. Amongst unskilled typists there will be variation due to the basic familiarity people have with the standard QWERTY keyboard. So, it is questionable whether execution speed, in and of itself, is as useful a measurement as it might be. It would be interesting to be able to measure something like processing time. This might be taken to mean the period of hesitation between hearing an editing command and pressing the first key in an attempt to solve it. The information could indicate a level of confidence in using the word processing system. For example, one would expect novice users to have a long hesitation between hearing and responding to an editing task because they may not have reached a stage of learning in which the verbal component is subdued. There might then follow a period of fast response as users rely on a limited number of commands to carry out all editing requests. At an expert stage there might be two levels: low-expert and high-expert. A secretary at a low-expert level might be slow because she would spend processing time weighing up alternative methods to approach each editing task; a Secretary at a high-expert level might be fast because the fine tuning required between connections is in place and the selection process is automatic.

Another method for exploring execution time and its relation to efficiency and style might be to devise an experimental situation where subjects are exposed to an editing problem and the amount and method used to solve the problem is measured both in terms of time taken as well as technique employed. An experimental technique similar to standard reaction time experiments could be constructed. Subjects could sit at a computer work station, be told the editing change to make and the editing problem would then appear on the screen in front of them. The subject would then have to work out how to locate the correct bit of text and make the editing change accordingly. The keys pressed could be stored in an inbuilt monitoring system of the computer. Subjects could be asked to use as many alternative techniques to solve the same problem in order to determine range of editing abilities as well as asked about a preferred technique to employ in certain situations.

Such a study as described here might yield information about the relationship between speed of execution, efficient use of editing techniques and a preferred style of editing. Such information could aid course designers and those responsible for supporting computer users to promote techniques perceived to be most relevant.

The Measurement of Error

The measurement of errors is another interesting area. Errors provide information about ability and confusion. As a measure on its own it may be less useful because while it is appropriate to know how often an individual makes errors, there are many different kinds, or levels, of errors. For example, is a typographical error of the same magnitude as using the wrong command? Is there a distinction between choosing the most appropriate command to fulfil a function and not being able to carry out the command correctly? So one element of exploring errors in word processing use is to classify them in terms of type of error.

Another area for further research is how errors are resolved, or corrected. Most novice typists can correct a typographical error pretty easily. But developing strategies for first detecting then diagnosing error states is very difficult for novice users. One measure of efficiency might be to gauge how users get themselves out of trouble. Again, it might be possible to design an experimental situation where errors occur and to observe the techniques used to recover from error states. Differences in both the efficiency of recovery and style of recovery might be apparent. This area of research is perhaps the most critical for trainers of users of word processing systems because all users make errors and the more self-sufficient they can become in solving errors the more control they have over the system.

Requesting Help

Another interesting area for further research is the use of requesting help. Throughout the period of data collection it was clear that some secretaries relied on asking questions as a way to find out what and how they were supposed to be doing things. Some used questions as a way of gaining time to work out a solution. Others asked questions because they simply did not know what to do.

And others again asked questions in order to extend their knowledge. It would be interesting and possible to go back to the original video tapes and examine in detail the use of questions.

Question asking style is probably related to more general personality characteristics and to the characteristics of cluster membership described in Chapter 7.

SUMMARY

This Chapter addresses the overall results obtained in this dissertation. The paradoxical results of this study were explored in terms of the distinction between efficiency and style and in terms of the methodological limitations of the study as described here.

The results suggest that there are training implications for secretarial users of word processing systems. One of the major findings of this study is that after one month of use the majority of secretaries are still using the word processing system in an unsophisticated way. There is little evidence for efficient use of editing techniques and little evidence for a consistent style of use.

Areas for further research were proposed to further the understanding of individual differences in both the efficiency and style of using a word processing system.

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APPENDICES

APPENDIX 1

PERSONNEL DEPARTMENT DOCUMENTS FOR WORD 5 COURSE

Creating Your First Document

1. Switch on the computer with the power switches on the system unit and on the monitor (the bottom switch).

   Change to the area of filespace on the fixed disk where you will be working by typing

   cd \usr\sec

   Call Word by typing

   word

   and then pressing the Enter key

2. After the Word screen appears, type some text to see the effect of line wrapping. Use the arrow keys to move around the screen. Use the backspace key (the ← above the large Enter key) to delete characters.

3. Use Alt/b to type in bold text. Return to normal text with Alt/Space or Alt/z.

4. Experiment with using Alt/i (italics) and Alt/u (underline).

5. Type a letter accepting an invitation to attend a conference in December using Italics, Bold and Underlining in the letter. Press the ENTER key when you wish to start a new line.

6. Save your first file onto the fixed disk as follows:

   - press the Esc key to transfer control to the command area.
   - select the *Transfer* command by pressing the Tab key until the command name is highlighted and then pressing the Enter key.
   - select the *Save* subcommand by using the Tab key and then pressing the Enter key.
   - type a name of your choice (up to 8 characters, no spaces) and press the Enter key.

   A copy of the text in the window is saved on the fixed disk of the PC. It has the name you gave it plus the suffix, .DOC. It remains there until it is deleted.

   As the text in the window has been saved you may now safely load another file. Loading another file causes the text currently in the window to be discarded. Always make sure you have saved the current text before loading another file.

NB: Where paragraph numbers are referred to in the following exercises, please use the numbers as per NUMBER.DOC at the end of these notes (even though the order changes in your file as you work through the practical).

Familiarisation with Transferring Files and the Screen

1. Load the file named LIDO.DOC into Word as follows:

   - press the Esc key to transfer control to the command area.
   - select the *Transfer* command by pressing the Tab key until the command name is highlighted then pressing the Enter key.
   - select the *Load* sub-command (which is already highlighted) by pressing the Enter key.
   - press the function key F1 to see a list of files on the screen. (Note the words 'select from list' on the message line).
   - highlight the filename LIDO.DOC. The name appears in the command field.
   - press the Enter key to execute the *Transfer Load* command.

A printout of the final formatted copy of this document is appended to these notes (VENICE.DOC).

2. Select the *Options* command and change the settings as follows:

   set *show ruler* to Yes, by:

   - using the tab key to move the the *show ruler* field.
   - Press the spacebar once to change the setting from No to Yes.

   set *show non-printing symbols* to All, by:

   - using the tab key to move to the *show non-printing symbols* field.
   - press the spacebar to change the setting from None to All.

   change the value of the *summary sheet* field to Yes

   set the *paginate* field to Auto - this will automatically put a dotted line into the document at the end of a page.

   Execute the command by pressing the Enter key.

3. You may notice some spelling mistakes throughout the document. Please resist the temptation to correct them as they will be used in a later demonstration.
4. Use the keys on the numeric keypad - ie Home, End, PgUp, PgDn and the arrow keys - plus the Ctrl key to move around the document. (See page 5 of the course notes for a list of the keys.) Return to the beginning of the document by using Ctrl PgUp.
5. Use the *Search* command to move the cursor to the text 'Delightful!.'
6. Use the → arrow key to move to the paragraph mark and delete the word 'Delightful!' using the Backspace key (above the Enter key, marked ←). Replace with the word 'Magic!'.
7. Insert the following sentence at the start of paragraph 8 (the paragraph numbers are shown on NUMBER.DOC attached to these notes):

   On the beach there are changing cabins, deck chairs and sun umbrellas, windsurfing, paddle and rowing boats for hire, as well as public areas without facilities.

8. Move to the top of the document using Ctrl PgUp, and experiment with using the *Replace* command. Use the *Undo* command to reverse the changes you make.
9. Select the *Transfer Save* command and save the revised text in a file named VENICE.DOC. (The extension .DOC is the default in Word; filenames can be typed in either upper or lower case).

Familiarisation with Blocks, Deletion and Copying

1. Practice highlighting different parts of the document using the function keys F6 - F10 and the Shift key. (See page 6 of the course notes for details.)
2. Use the *Search* command to find paragraph 7. Move paragraph 7 to before paragraph 6.
3. Make a copy of the paragraph 6 and insert it at the end of the document.
4. Delete the paragraph 6 you have just copied from.
5. Save the current version of the file (as VENICE.DOC).
6. Use the *Print preView* command to see how your document will print out. Use the *Exit* command to return to the text window.

Character Formatting

1. Make paragraph 1 (ie the title) bold and uppercase.
2. Using the Alt key codes from the list on Page 8 of your course notes, make paragraph 2 bold.
3. Make the acknowledgement 'The Magic of Italy, Thomson, Holidays, 1989' in paragraph 3 italic (use the function key F6 to highlight text that is not a word, sentence or paragraph).
4. Check that *Print Options* has printer set to POSTSCRP and setup: to LPT1: Press Enter to return to Printer menu. **DO NOT PRINT YOUR DOCUMENT** but escape from this command by pressing the Esc key to return to the text window.
5. Change the font name throughout the document to TIMES-ROMAN and the font size to 11 point. You need to highlight the *whole* document to do this. Font sizes are measured in points, that is the height of the character. Pitch size is the width of the character, (except in the case of proportional fonts). Remember:

   10 point = 12 pitch
   12 point = 10 pitch
6. Save the document as VENICE.DOC.

Paragraph Formatting

1. Define the paragraphs in the body of the document to be justified with 1 line of space after the paragraph. (Refer to the list of Alt keys found in your course notes on Page 9 for this and other paragraph formatting).
2. Make paragraph 1 centered and set the *space after* field to *1* and the *keep follow* field to *Yes*
3. Give paragraph 2 a right and left indent of ½ inch by putting the measurement 0.5" in the left and right indent fields of *Format Paragraph.*
4. Make paragraph 3 right aligned .
5. Using the printout named VENICE.DOC at the end of your notes as an example continue typing the document, starting with the cursor on your final paragraph mark and pressing Enter (to carry down the paragraph and character formats already defined). Commence by typing the words 'Hotel Quattro...', and format the text as you type as follows:
   - Make paragraph 9 underlined (Alt/u). Ensure the cursor is highlighting the paragraph mark before removing the underline format with Alt/Space.
   - Justify paragraph 10.

   Stop typing at the end of paragraph 11.
6. Use the *Print preView* command to see how your document will print out. Use the *Exit* command to return to the text window. Your document will not look exactly as the printout of VENICE.DOC until all the formatting has been completed.

Hanging Indents

1. Create a hanging indent for paragraph 12 as follows:
   - Type in the word 'Bedrooms' followed by a tab character. Continue typing the paragraph with no formatting, allowing the lines to wrap around.
   - Use Alt/t to form a hanging indent (you may have to press Alt/t twice to line up the text on the screen). Select *Format Paragraph* to see the effect of Alt/t on the indents.

- Set value of the *space after* field to *1* and the *keep together* field to *Yes*.
- Carry down the formatting by ensuring that the cursor is on your last paragraph mark and pressing Enter. Type in paragraphs 13 and 14 as above.

2. Experiment with the effects of deleting and reinserting paragraph marks in your document.
3. Check that all your characters are in TIMES-ROMAN 11 as follows:
   - use Ctrl PgUp to put the cursor at the top of your document.
   - use the *Format repLace Character* command.
   - ensure *confirm* is set to Yes.
   - in the *font name* field type Courier and in the *font size* field type 12. Press the Enter key.
   - you are now in the *Replace with character format* menu. In the *font name* field type TIMES-ROMAN and in the *font size* field type 11. Press the Enter key.
   - any text which is in Courier 12 will be highlighted and you will be asked if you wish to replace this with TIMES-ROMAN 11. Press Y.
4. Make a new paragraph at the top of your document by placing the cursor on the first character of the title and pressing Enter. Move the cursor up and type in your name.
5. Save the document with the same name as before, ie VENICE.DOC.
6. See how your document will print out with the *Print preView* command.
7. Highlight the three hanging indents you have just typed (that is paragraphs 12, 13 and 14) and press Alt/p to take off the previous formatting. Set a left aligned tab at 1.3". Select the *Format Tabs Set* command. In the *position* field type 1.3" and press Enter. Press Alt/t to reposition the hanging indents.
8. Save your document and view it with the *Print preView* command.

Setting Tabs

1. Clear the text window using the *Transfer Clear All* command. Create a new document called TABLE.DOC by using the *Transfer Load* command.
2. Type the heading 'Price' and underline it. Make a new line for '(for Bed and Breakfast, per person)' using a Newline character (ie Shift Enter). Finish typing paragraph 15 and press Enter. Move the cursor back into paragraph 15 and use *Format Paragraph* to set *space after* to 1 line and *keep follow* to *yes*.
3. Type in the information in paragraph 17 using newline characters at the end of lines, finishing the final line with a paragraph mark (Enter). With the cursor in this paragraph, set two right aligned tabs at 2.1" and 5.9" and one left aligned tab at 3.4". Set *the keep together* field of *Format Paragraph* to *Yes*
4. Put the cursor on the first character of the table (ie 1) and press Enter to insert a new paragraph. Before typing paragraph 16, clear the tabs already set with *Format Tabs Reset* command (these have been carried with the paragraph mark for paragraph 17). Set centre aligned tabs at 2.1" and 5.8" by pressing F1 to put the cursor on the ruler, moving to the correct position and pressing C. Set a left aligned tab at 3.5" in the same way but press L. Type in the headings with tab characters between. Press Enter.
5. Highlight the whole document and set the *font name* field to TIMES-ROMAN and the *font size* field to 11. Save TABLE.DOC with the *Transfer Save* command and use *Print preView* to see how it will print out.
6. Re-load VENICE.DOC with the *Transfer Load* command.

7. Ensuring that the cursor is at the end of VENICE.DOC on the end mark (a diamond), select the *Transfer Merge* command and insert the filename TABLE.DOC. Press Enter to merge your table into VENICE.DOC.
8. Type in another table making up headings and text of your own using numbers and decimal and vertical tabs. Experiment with deleting and inserting paragraph marks. Before continuing delete your own table from the document.

Spelling Checker

1. Save the file as VENICE.DOC.
2. Select the *Library Spell* command(or use Alt/F6 to run the spell checker):
    - choose *Correct* to change words which are incorrectly spelt. Word then offers a list of possible spellings. Use the arrow keys to select the correct one.
    - choose *Ignore* to leave any words that Word does not recognise but which you know are correct (these are usually words which are proper names or which are not in Word's standard dictionary, eg deckchairs).
    - when the whole document has been proof read, select the *Exit* command to leave the spelling checker.
    - Save the file.

The *Library Spell* command checks the document from the current cursor position to the end of the document. If the cursor is not at the beginning of the document when you give the *Library Spell* command, the spell checker checks the document until it reaches the end and then asks you to type *Y* to continue spell checking from the top of the document.

Division Formatting

1. Select the *Format Division Margins* command and set the left and right margins to 1", the bottom margin to 1" and the top margin to 1". Check the page size is 11.69 by 8.27 inches.
2. Format the paragraph containing your name at the top of the document into a running head. Use *Format Running-head* to check that the running head is set to *Top*, and set *Yes* for odd, even and first pages. Set the alignment to *Left-margin*.
3. With the cursor at the top of your document, make a new paragraph by pressing Enter. Move the cursor onto this new paragraph mark and format this as a centered running head with a page number at the bottom of the page as follows:
    - Use the *Insert* command and select the glossary item 'page' from the list.
    - Press Enter and centre the paragraph. Format the paragraph as a bottom running head to align with the left margin.
    - Ensure that the running heads are in the TIMES-ROMAN 11 point font.
4. Use the *Print/preView* command to check the running heads will print out as required. Use the *Exit* command to return to the text window.
5. Save the file with the same name.

Footnotes

1. Insert the footnote 1 as shown on the second page of the printout of VENICE.DOC. Make the footnote reference mark 1 superscript and TIMES-ROMAN 9 in both the document and the footnote text, and italicise the words shown in the footnote text.

2. Using the *Jump Footnote* command, jump from the footnote text to the reference mark in the document. Now insert footnote 2 in the appropriate place making sure that you format the reference mark and text as for footnote 1.

Printing

1. Check again that all characters (including the running heads and footnotes) are in TIMES-ROMAN. You can do this by using the *Format sEarch Character* command to check your document for Courier text.
2. Use the *Print Repaginate* command to check the pages break at suitable points. Change the position of the page breaks if necessary.
3. Save the file and use *Print preView* to see how it will print out.
4. Quit from Word using the *Quit* command.
5. At the prompt C:\USR\SEC> type:

   copy venice.doc a:
6. When you receive the message *(1 file copied)*, remove your disk and take it to the Lecturer's system to print out.
7. At the Lecturer's system put your disk in the drive and at C:> type

   a:

   You are now working from your floppy disk.
8. Get into Word and load up Venice.doc. Print this document using the *Print/Printer* command.
9. When you have printed your document, quit from Word, and then remove your floppy disk.

Using the Disk Operating System - DOS

1. Change directory to \USR\SEC (if you are not already in this directory):

   cd \usr\sec

   (Notice that the prompt changes.)

2. List all the files in this directory:

   dir

3. List all the Word files in the directory:

   *dir *.doc*

4. List all the Word backup files in the directory:

   *dir *.bak*

5. Rename the files VENICE.DOC and VENICE.BAK to be NEW.DOC and NEW.BAK:

   rename venice. new.**

   List the files in the directory again to check that the files have been renamed correctly.

6. Put the floppy disk in drive A.

7. Format the disk in drive A:

   format a:

   Enter your name when prompted for a Volume Label.

8. Copy the file NEW.DOC on to the floppy disk in drive A:

   copy c:new.doc a:new.doc

9. Make A your current drive:

   a:

   Notice that the prompt has changed.

10. List the files on the current drive (drive A):

    dir

11. Copy the file NEW.BAK from C to A:

    copy c:new.bak a:new.bak

12. List the files on A:

    dir

13. Delete the file NEW.BAK on A:

    del new.bak

14. Delete the file NEW.DOC on A:

    del new.doc

15. List the (now empty) disk on A:

    dir

16. Make C the current drive again:

    c:

17. Take the floppy disk out of drive A.

18. Change directory to the root directory:

    *cd *

19. Change directory to \USR:
    cd \usr
20. Make a new directory below \USR giving it your initials, eg:
    md km
21. Change to this new directory, eg:
    cd km

    Notice how the prompt has changed.
22. Copy the file NEW.DOC from the directory \USR\SEC into your new directory:
    copy \usr\sec\new.doc new.doc
23. List the files in your new directory:
    dir
24. Change directory back to the root directory:
    *cd *
25. Switch off the system.

THE MAGIC OF VENICE LIDO

Venice Lido, with its magnificent stretch of fine sandy beach, was discovered and developed for the world's most exclusive and discerning travellers. They wanted to have their cake and eat it: enjoy the splendours of Venice and relax on a beautiful sandy beach. And how right they were - for this is surely the ideal way to visit Venice!

(taken from *The Magic of Italy, Thomson Holidays, 1989*)

Few people realise that on Venice Lido you have one of the most attractive and exclusive beach resorts on the Adriatic coast. Here there are no high rise hotels or over-development. The island is essentially residential with many fine old villas set in gardens; some now converted into charming hotels. The fine sandy beach is extremely wide and where deckchairs and umbrellas are available on well-kept lidos, there is ample space for all, even in July and August.

Cognoscenti have been taking their beach holidays on Venice Lido since the turn of the century when fine old hotels like the Excelsior and Des Bains were first erected.

In this relaxed and peaceful atmosphere you can spend your days on the beach or exploring the secret corners of the island, and your evenings in the exciting city centre only a few minutes boat ride away across the lagoon.

On the beach there are changing cabins, deckchairs and sun umbrellas, windsurfing, paddle and rowing boats for hire, as well as public areas without facilities. A bus service operates along the island which is about 7 miles long although only half a mile across at its narrowest points.

The island lies across the mouth of the Lagoon and the long, wide beach of fine sand is washed by the Adriatic sea. On the Lagoon side the Lido looks across the water to St Mark's Square which is only a 15 minute boat ride away, with frequent ferry services.

Hotel Quattro Fontane

To find an English country cottage in a peaceful garden so close to Venice is surprising, but the wealthy Venetians who originally created this as their summer residence in the 19th century were great admirers of English style. A separate wing on more traditional Venetian lines was added later and a wonderfully inviting country-house atmosphere has been lovingly maintained by the Bevilacqua family who have owned the hotel for over 30 years.

The following facilities are available:

Bedrooms	The enchanting bedrooms are each named after famous Palladian Villas and have bath or shower/wc, TV and air-conditioning.
Restaurant	The restaurant offers fine local and international cuisine. There is a piano bar in the evenings and in July and August a small band sometimes plays on the terrace. Breakfast and dinner are often served in the garden.
Ferry	A convenient waterbus service to St Mark's operates on summer afternoons and evenings from a canal only 50 yards away and it is just under a mile to the main ferry stage.

Price[1]
(for Bed and Breakfast, per person)

Code	No. of Nights	Departure Dates	Cost(£)[2]
1162	7	Mar 10 - Apr 24	329
1163	7	Apr 25 - July 6	484
1164	14	Apr 25 - July 6	715
1165	7	July 7 - Sept 30	565
1166	14	July 7 - Sept 30	876

1 Anniversary and honeymoon special savings per person on minimum 7 night holidays

2 Supplements per person per night: Half board: £18; Single room: £11; Twin for single use: £15

Practical Notes

Please ask for help whenever you get stuck or would like more information.

Creating your first document

Switch on the computer with the power switches on the system unit and on the monitor.

Change to the area of filespace on the fixed disk where you will be working by typing

cd \usr\sec (press the Enter key)

Call Word by typing

word (press the Enter key)

After the Word screen appears, type two or three sentences of text to see the effect of line wrapping, that is, not having to press the Enter key at the end of each line of text. Use the arrow keys (on the numeric keypad) to move around the screen. Use the Backspace key to delete characters (the Backspace key is the grey key above the Enter key).

Use Alt/*b* to type in bold text (hold down the Alt key and then press and release the B key). Return to normal text with Alt/Space.

Experiment with using Alt/*i* (italics) and Alt/*u* (underline).

Save your first file, that is, the document you have just typed onto the fixed disk by:

- pressing the Esc key to transfer control to the command area.
- selecting the *Transfer* command by pressing the Tab key until the command name is highlighted and then pressing the Enter key. The Tab key is a grey key, to the left of the Q.
- selecting the *Save* subcommand by using the Tab key and then pressing the Enter key.
- typing a name of your choice (up to 8 characters, no spaces) and pressing the Enter key.

You are then presented with a summary sheet. The information on the sheet can be very useful for document retrieval. It is up to you whether you choose to fill it in. To leave it blank just press the Enter key. To fill it in, press the Tab key to move to each field and then type some appropriate text describing the file. When you have finished filling in the summary sheet, press the Enter key.

A copy of the text in the window is saved on the fixed disk of the PC. It has the name you gave it plus the extension, .DOC. It remains there until it is deleted.

As the text in the window has been saved you may now safely load another file. Loading another file causes the text currently in the window to be discarded. Always make sure you have saved the current text before loading another file.

NB: Where paragraph numbers are referred to in the following exercises, please use the numbers as per INDEX.DOC at the end of these notes (even though the order changes in your file as you work through the practical).

Familiarisation with transferring files and the screen

Load the file named SOURCE.DOC into Word as follows:

- press the Esc key to transfer control to the command area.
- select the *Transfer* command by pressing the Tab key until the command name is highlighted then pressing the Enter key.
- select the *Load* sub-command (which is already highlighted) by pressing the Enter key.
- press the function key F1 to see a list of files on the screen. (Note the words `select from list` on the message line).
- highlight the filename SOURCE.DOC using the arrow keys. When it is highlighted, the name also appears in the filename field.
- press the Enter key to execute the *Transfer Load* command.

A printout SOURCE.DOC can be seen at the back of these notes.

You may notice some spelling mistakes throughout the document. Please resist the temptation to correct them as they will be used in a later demonstration.

The *Options* command has a field, that is, a section of the menu, called *show non-printing symbols*. If this is set to *All*, every character that you type is displayed on the screen. Spaces are displayed as small dots, tabs are displayed as small arrows, paragraph marks (obtained by pressing Enter) are displayed as backward 'p' symbols. (These special characters appear only on the screen; they are not printed when the file is printed).

Select the *Options* command and set *show non-printing symbols* to *All* by doing the following:

- pressing the Esc key to transfer control to the command area.
- selecting the *Options* command (press the Tab key to highlight *Options*, then press the Enter key).
- use the Tab key to move the highlight to the *show non-printing symbols* field. Change its setting from *None* to *All* (by pressing the Spacebar twice).
- execute the command by pressing the Enter key.

Look at the text in the window and make sure you can identify spaces, and paragraph marks.

Word can display a ruler at the top of the text window. The ruler marks the beginning and end of each line of text and marks where any tab stops have been set (see later for tabs). The ruler is switched on from within the *Options* menu.

Word automatically shows where the page breaks appear in the document, provided the *paginate* field of the *Options* command is set to *Auto* (to paginate a document means to divide the document into pages). Page breaks appear as a row of dots across the screen.

The line number of the current line is displayed (together with the page number and column number) when *line numbers* is set to *Yes* within the *Options* menu.

Select the *Options* command and set *show ruler* field to *Yes*, the *paginate* field to *Auto* and *line numbers* field to *Yes* by doing the following:

➤ press the Esc key then select the *Options* command (by pressing the Tab key).

➤ execute the command by pressing the Enter key.

➤ move the highlight to the *show ruler* field (again by pressing the Tab key).

➤ change the value of the field to *Yes* by pressing the Space bar.

➤ move the highlight to the *paginate* field (using the Tab key), and set *paginate* to *Auto* (using the Space bar).

➤ move the highlight to the *line numbers* field (using Tab) and set it to *Yes* (using the Space bar).

➤ finally execute the command by pressing the Enter key.

Look at the bottom left of the screen and notice that as you move the cursor through the document the line number changes

The keys on the numeric keypad - that is, Home, End, PgUp, PgDn and the arrow keys are used in conjunction with the Ctrl key to move around the document. (See page 5 of the course notes for a list of the keys.) Use these keys to practice moving around the document.

Return to the beginning of the document by using Ctrl/PgUp.

By now you may have found that it is tedious to have to keep using the Tab key to select a command and then pressing the Enter key to execute the command. There is a quicker way of giving a command - by pressing the capital letter of the command name, usually the first letter (for example, pressing the *T* key for the *Transfer* command).

Somewhere in SOURCE.DOC is the text 'geographical'.

The *Search* command is used to locate text within your document. Unless you change it, Word searches from the current cursor position to the end of the document. It is therefore important to make sure the cursor is at the top of the document if you wish the whole of the document to be searched.

Use the *Search* command to move the cursor to the word 'geographical', as follows:

➤ press the Esc key.

➤ select the *Search* command.

➤ type the word *geographical* in response to the *text* field prompt.

➤ check that the *direction* field is set to *Down*.

➤ press Enter.

Use the right arrow key to move to the following space and use the Backspace key (above the Enter key) to delete the word 'geographical'. Replace with the word 'socio-economic'.

Insert the following sentence at the start of paragraph 8 which begins 'Corn Street ...' (the paragraph numbers are shown on INDEX.DOC attached to these notes). You will need to put the cursor on the 'C' of 'Corn' and then start to type in the following text:

> *Ancient churches are dotted around the City, while museums abound for visitors. As well as the City of Bristol Museum and Art Gallery there is an up-to-the-minute Industrial Museum on the side of the City Docks*

Move to the top of the document using Ctrl/PgUp.

The *Replace* command is used to change one piece of text for another piece of text throughout the document. For example, to replace every occurrence of 'docks' in the text with the word 'harbour' do the following:

- ➤ move to the top of the document (using Ctrl/PgUp).
- ➤ select the *Replace* command.
- ➤ specify *text* as *docks* and *with text* as *harbour.*
- ➤ set *confirm* to *Yes.*

The *case* field specifies whether case (that is, upper or lower case) is to be significant. If you set *case* to *No*, then case is ignored and the *Replace* command will replace 'docks', 'Docks' or 'DOCKS' (with 'harbour', 'Harbour' or 'HARBOUR'). If *case* is set to *Yes* then only 'docks' is replaced.

If *whole word* is set to *Yes* then the command will replace 'docks' but not 'dockside'.

Experiment with using the *Replace* command. Use the *Undo* command to reverse the change you have just made. The *Undo* command can only undo the last edit.

Select the *Transfer Save* command and save the revised text in a file named BRISTOL.DOC. (The extension .DOC is the default in Word; filenames can be typed in either upper or lower case).

Familiarisation with blocks, deletion and copying

Function keys are used to highlight blocks of text. Once the text has been highlighted it can be formatted, deleted, copied or moved.

Practice highlighting different parts of the document using the function keys F7 - F10 and the Shift key. (See page 6 of the course notes for details.)

The F6 key is used to highlight text which is not a word, nor a paragraph, nor a sentence, etc.

Practice using the extend key (F6). To use the extend key:

- ➤ place the cursor at the start of the block you wish to highlight.
- ➤ press F6 to switch on extend mode (denoted by EX at the bottom right of the screen).
- ➤ use the arrow keys to paint in an area of text.
- ➤ press F6 again to switch off extend.

Word has an area where text can be stored temporarily. This is known as the **scrap**. Blocks of text can be copied from the text area to the scrap using the *Copy* command and inserted elsewhere using the *Insert* command (or the Ins key).

Alternatively text can be deleted (that is, removed) from the text area and placed in the scrap using the *Delete* command (or the Del key). The scrap is shown as a pair of curly brackets { } at the bottom of the screen.

Move paragraph 7 to before paragraph 6 (refer to the unformatted printout of INDEX.DOC at the end of these notes for the paragraph numbers). To do this you need to:

- locate paragraph 7 in the document using the *Search* command. Paragraph 7 is the one which begins 'Bristol has preserved ...'.
- highlight the paragraph with the appropriate function key.
- delete the highlighted text to the scrap using the *Delete* command (or the Del key).
- place the cursor at the beginning of paragraph 6. (Paragraph 6 starts 'Much of Bristol's ...')
- insert the text from the scrap using the *Insert* command (or the Ins key).

  Note that text copied to the scrap overwrites any existing text in the scrap.
- copy paragraph 6 to the scrap using the *Copy* command and insert it at the end of the document.
- delete the paragraph 6 you have just copied from by highlighting it using the F10 key and then deleting it using the *Delete* command (or the Del key).

Save the current version of the file (as BRISTOL.DOC).

Use the *Print preView* command to see how your document will print out by pressing the Esc key to get to the command area and pressing *P* (for Print) and *V* (for preView). Press *E* (for Exit) when you are ready to return to the text window.

Formatting

Character formatting

Character formatting within Word controls the appearance of characters. Character formatting includes: changing the font(commonly referred to as a typeface), making text bold, uppercase (that is, capital letters), italics etc. The text can either be formatted as it is typed, or by highlighting a block of text and then formatting that block.

If no text is highlighted, any formatting instructions you give are carried out on the next piece of text typed (until the formatting is reset). If a block of text is highlighted then only the highlighted text is formatted.

Make the characters in paragraph 1 and 2 bold as follows:

- move to the top of the document.
- use F6 to switch on extend.

- use F10 to highlight paragraph 1 and 2.
- switch off extend with F6.
- use the *Format Character* command to change the formatting of the highlighted text.

Make the characters in paragraph 1 uppercase.

Make the text 'The County of Avon' in paragraph 3 italic. Use the function keys F6 and F8 to highlight the text. You can make the highlighted text italic either using the *Format Character* command or Alt/*i*.

Different fonts are available for different printers. It is therefore important to ensure that the correct printer has been selected before using the *Format Character* command to change the font of any text. Word remembers the print options from session to session. Once the correct printer has been selected it should not normally need to be changed.

Check that *Print Options* has printer set to *POSTSCRP*. Press Esc to return to the text window.

Use the *Format Character* command to change the font name throughout the document. Set the *font name* to *TIMES-ROMAN* and the *font size* to *11* point.
NOTE: You need to highlight the *whole* document (Shift and F10) to do this.

Originally the text of SOURCE.DOC was in COURIER 12 point font. COURIER is a fixed pitch font, that is, each character takes up the same amount of space. A proportionally spaced font is one where the different characters take up different amount of space, eg letter i's take up less space than letter w's. These notes are printed in a proportional font.

Point is an indication of a character's size. It is a measure of the height of the character. 12 point is larger than 10 point.

In some instances, Word does not show text exactly as it will be printed. Word can only display text on the screen as 12 point, fixed pitch characters. But the characters used are 10 point, that is, smaller, so that more characters can fit on a line. *Options show line breaks*, or *Options show layout* can be used to find out which words appear on which line.

Save the document as BRISTOL.DOC.

Paragraph formatting

Paragraph formatting controls the appearance of paragraphs of text. Paragraphs can be left aligned, centred, right aligned or justified (aligned on both margins). Paragraphs can be indented (using *first line* indent) or separated by blank lines (using *space after*).

As with character formatting, paragraphs can be formatted as they are typed, or by highlighting text and then formatting the highlighted text.

Use the *Format Paragraph* command to define all the paragraphs in the document with 1 line of space after the paragraph (set space after to 1).
NOTE: make sure you highlight the whole document to do this.

Make paragraph 1 centered.

Make paragraph 2 aligned on both margins (that is, set *alignment* to *Justified*). Give this paragraph a right and left indent of half an inch by putting the measurement 0.5" in the left and right indent fields of *Format Paragraph.*

Make paragraph 3 right aligned.

A list of Alt sequences for paragraph formatting is given in the document D3.6.1.

Using the printout named BRISTOL.DOC at the end of your notes as an example continue typing the document, starting with the cursor on your final paragraph mark and pressing Enter (to carry down the paragraph and character formats already defined). Commence by typing the words 'Well Provided ...', and format the text as you type as follows:

- ➤ make paragraph 9 bold (Alt/*b*). Ensure the cursor is highlighting the paragraph mark before removing the emboldening format with Alt/Space.
- ➤ make paragraph 11 bold and stop typing at the end of paragraph 11.
- ➤ use the *Print preView* command to see how your document will print out. Use the *Exit* command to return to the text window. Your document will not look exactly as the printout of BRISTOL.DOC until all the formatting has been completed.

Hanging indents

Hanging indents are very common in text especially where paragraphs are numbered. The paragraphs with bullets (➤) in this document are examples of hanging indents.

In a hanging indent all the text in the paragraph is indented, except the first line. This usually has a bullet or an identifying number or letter which is aligned with the left margin. There must be a tab character on the first line of the paragraph following the number or letter. The tab is used to ensure that the text on the first line is aligned with the rest of the text in the paragraph.

Create a hanging indent for paragraph 12 as follows:

- ➤ type in the words 'Local Government' followed by a tab character. Continue typing the paragraph with no formatting, except for new line characters.
- ➤ use Alt/*t* to form a hanging indent (you may have to press Alt/*t* several times to line up the text on the screen). Select *Format Paragraph* to see the effect of Alt/*t* on the indents.
- ➤ set the value of the *space after* field to *1* and the *keep together* field to *Yes*.
- ➤ carry down the formatting by ensuring that the cursor is on your last paragraph mark and pressing Enter. Type in paragraphs 13 and 14 as above.

Experiment with the effects of deleting and reinserting paragraph marks in your document.

Check that all your characters are in TIMES-ROMAN as follows:

- ➤ use Ctrl/PgUp to put the cursor at the top of your document.
- ➤ use the *Format repLace Character* command.
- ➤ ensure *confirm* is set to *Yes*.
- ➤ in the *font name* field type *COURIER* and in the *font size* field type *12*. Press the Enter key.

- you are now in the *Replace with character format* menu. In the *font name* field type *TIMES-ROMAN* and in the *font size* field type *11*. Press the Enter key.
- any text which is in COURIER 12 will be highlighted and you will be asked if you wish to replace this with TIMES-ROMAN 11. Press *Y*.

Make a new paragraph at the top of your document by placing the cursor on the first character of the title and pressing Enter (your new paragraph will have the same formatting as the title, that is, uppercase, bold and centred. Move the cursor up and type in your name.

Save the document with the same name as before, that is, BRISTOL.DOC.

See how your document will print out with the *Print preView* command.

Setting tabs

Tabs are frequently used in tables to line up columns of text (see later).

Using tabs is a two stage process. The first step involves setting the tab positions. This is done using the *Format Tabs Set* command. The second stage is actually including tab characters in the text using the Tab key. Tab characters appear on the screen as small right arrows. Normally tab characters are inserted as the text is typed.

Highlight the three hanging indents you have just typed (that is paragraphs 12, 13 and 14) and press Alt/*p* to take off all the previous formatting. Set a left aligned tab at 3" as follows:

- select the *Format Tabs Set* command. In the *position* field type *3"*. (The other command fields need not be changed - the *alignment* should be *Left* and the *leader character* should be *Blank*. These are the default settings, that is, that is what you get unless you change them). Press Enter. Press Alt/*t* to reposition the hanging indents. Select *Format Paragraph* and reset *space after* to *1* line and *keep together* to *Yes*.
- save your document and view it with the *Print preView* command.

Tables

Tables are made easier by setting tabs with different alignments. The possible alignments are:

Left	so the text moves to the right of the tab. This alignment is used most often for text.
Centre	any text will splay out to the right and left of the tab position. This is useful for column headings.
Right	so the text moves along to the left of the tab. This is useful for numbers in order to keep the units, tens and hundreds in the right columns.
Decimal	the decimal point in numbers is aligned with the tab. If text has no decimal point, the text is right aligned.
Vertical	A vertical line is drawn in the document at the tab setting.

When typing more than one line of information in a table, finish the line with a newline character (obtained with Shift/Enter and shown as a down arrow on the screen) instead of a paragraph mark (Enter). Newline characters ensure the table is kept as one paragraph.

Tab settings, like paragraph formats are stored with the paragraph mark. It is important to ensure that having set up a table you don't inadvertently delete the paragraph mark and lose the tab settings.

Type in a simple table into a new file as follows:

- clear the text window using the *Transfer Clear All* command and create a new document called TABLE.DOC by using the *Transfer Load* command.
- type the heading 'The Districts of the County of Avon' and make it bold. Press Enter. Move the cursor back into paragraph 15 and use *Format Paragraph* to set *space after* to *1* line and *keep follow* to *yes.*
- start each line with a tab character and type in the information in paragraph 17 using tabs between each word and newline characters at the end of lines, finishing the final line with a paragraph mark (Enter). With the cursor in this paragraph, set a left aligned tab at 0.5" and two right aligned tabs at 3" and 5". Set *the keep together* field of *Format Paragraph* to *Yes*
- put the cursor on the first character of the table (that is, a tab character) and press Enter to insert a new paragraph. Before typing paragraph 16, clear the tabs already set with *Format Tabs Reset* command (these have been carried with the paragraph mark for paragraph 17). Type in the headings with tab characters between. Set centre aligned tabs to position the headings over the columns in the table. Use *Format Tabs Set* and press F1 to put the cursor on the ruler. Move to the correct position and press *C.*

Highlight the whole document and set the *font name* field to *TIMES-ROMAN* and the *font size* field to *11*. Save TABLE.DOC with the *Transfer Save* command and use *Print preView* to see how it will print out.

Re-load BRISTOL.DOC with the *Transfer Load* command.

Ensuring that the cursor is at the end of BRISTOL.DOC on the end mark (a diamond), select the *Transfer Merge* command and insert the filename TABLE.DOC. Press Enter to merge your table into BRISTOL.DOC.

Checking spelling

Word has a built-in spelling checker. This is run using the *Library* command.

Save the file as BRISTOL.DOC.

Check the document for incorrect spellings by doing the following:

- move to the beginning of the document (using Ctrl/PgUp).
- select the *Library Spell* command (or use Alt/F6 to run the spell checker)
- choose *Correct* to change words which are incorrectly spelt. Word then offers a list of possible spellings. Use the arrow keys to select the correct one.
- choose *Ignore* to leave any words that Word does not recognise but which you know are correct (these are usually words which are proper names or which are not in Word's standard dictionary, for example, deckchairs).
- choose *Add* to add any words to a dictionary.

- when the whole document has been proof read, Word displays a message indicating the number of words checked and the number of words unknown.
- save the file.

The *Library Spell* command checks the document from the current cursor position to the end of the document. If the cursor is not at the beginning of the document when you give the *Library Spell* command, the spell checker checks the document until it reaches the end and then asks you to type *Y* to continue spell checking from the top of the document.

Division formatting

Division formatting controls the layout of the page. Page length, page width and margin sizes are amongst the values set by the *Format Division Margins* command.

Select the *Format Division Margins* command and set the left and right margins to 1", the bottom margin to 1" and the top margin to 1". Check the page size is 11.69 inches by 8.27 inches (standard A4 paper size)

Use Ctrl/PgDn to move to the bottom of the file. There should be a row of colons (or double row of dots) at the end of the document. This is a division break. Do not delete this, as the division formatting is stored with the division break.

Running heads

Running heads are lines of text which appear at the top or bottom of every page of a document. They are entered at the beginning of the document, but only appear in their correct positions when the document is printed.

Format the paragraph containing your name at the top of the document into a running head.

- move the cursor into the paragraph containing your name and remove any existing character formatting such as bold.
- format the paragraph to be right aligned.
- use *Format Running-head* to format the paragraph as a top running head with the options set to *Yes* for *odd, even* and *first pages* and the *alignment* set to *Left-margin.* Note that a caret (^) appears on the screen to the left of the paragraph, this indicates that the paragraph is a running head.

Similarly, put the page number centred at the bottom of every page. Put a new paragraph mark at the top of the document and centre it. Then insert the page number into the paragraph by using the glossary item page:

- select the *Insert* command.
- press F1 to list the glossary items available.
- use the arrow keys to select 'page' from the list of glossary items.
- press the Enter key.

Make the paragraph into a bottom running head - so that the page number appears at the bottom of every page.

The bottom running head, like the top running head must be at the beginning of the document. You can only view its correct position using *Print preView*.

The glossary item page acts as a counter which is incremented automatically after every page.

Other glossary items are available to show the date and time, or the date and time when the document is printed (see page 7 of the course notes). It is possible to create glossary items of your own. Use the on-line help, the manual or ask for help if you think this would be of use.

Use the *Format Character* command to check that both running heads are in TIMES-ROMAN font size 11. Use *Print preView* to check that the running heads appear correctly on all pages. Save the file.

Footnotes

Footnotes can occur either at the bottom of the page on which they are mentioned (footnotes) or all together at the end of the document (they are then known as endnotes). Use the *Format Division Layout* command to set footnotes to *same-page* or *End*

Footnotes are inserted using the *Format Footnote* command. Word sorts the footnotes at the end of the document. (The end of the document is marked by a diamond). Footnotes only appear in their correct positions when the document is printed or previewed.

Insert the two footnotes shown on the second page of the printout of BRISTOL.DOC. To insert a numbered footnote:

➤ position the cursor where the footnotes reference is to be (after Population for the first footnote).

➤ select the *Format Footnote* command.

➤ press Enter in response to the reference mark prompt.

➤ type the text of the footnote.

Format the footnote reference mark to be *superscript* and *TIMES-ROMAN 9.*

Use the *Jump Footnote* command to jump between the footnote text to the reference mark in the document.

Create the second footnote (shown on page 2 of the printout) in the appropriate place

Ensure that the footnotes are in 9 point *TIMES-ROMAN* (use the *Format Character* command). Use *Print preView* to see how the footnotes are positioned on the page.

Printing

Use the *Print Options* command to check that the printer is set to *POSTSCRP* and *setup* is *LPT1:* Then use the *Format sEarch Character* command to check for any text which is in *COURIER* font. Use the *Format Character* or the *Format repLace Character* command to change the *COURIER* to *TIMES-ROMAN 11* point.

Use the *Jump Footnote* command and the *Format Character* command to check that all the footnote reference marks are in 9 point.

Use the *Print Repaginate* command with *confirm page breaks* set to *Yes* to find out where the page breaks will occur when the document is printed:

➤ use the up arrow key to change the position of the page breaks if necessary.

- type *Y* when you have placed the cursor in the correct position for the page break.
- use *Print preView* to give the document a final check before printing. Try to ensure there are no errors before actually printing the document.
- save the file.

If a printer was attached to the PC, you would print the document using the *Print Printer* command. The printer on this course is attached to the Lecturer's system only so copy your files as follows and print on the Lecturer's system:

- quit from Word using the *Quit* command
- insert a floppy disk into the disk drive.
- at the prompt `C:\USR\SEC>` type:

    copy bristol.doc a:

- when you receive the message `1 file copied`, remove your disk and take it to the Lecturer's system to print out.
- at the Lecturer's system put your disk in the drive and at `C:>` type

    a:

    You are now working from your floppy disk.

- get into Word and load up Bristol.doc. Print this document using the *Print/Printer* command.
- when you have printed your document, quit from Word, and then remove your floppy disk. Alternatively you can stay in Word but use the *Transfer Clear All* command to clear the screen before removing your disk.

Use the manual or the help system to find out how you would print two copies of your document, or if it was a long document how you would print only page 2 and not the other pages.

1 The City of Bristol

2 Bristol, originally called Brigstow, means 'the place of the bridge' presumably referring to the bridging point of the River Avon. In Norman times a large castle was built on the east side of the town within the narrow spur of land where the Avon and Frome rivers meet. By 1400 the City was the largest western seaport and by 1500 it was the second city in the country next to London. In the 19th century, failure to modernise the docks adequately, despite the efforts of Brunel and others, drove away much traffic to the booming rival of Liverpool. Fortunately, as the port began its long decline, so Bristol's importance grew as a manufacturing, trading and commercial centre. Bristol and Avon have continued to diversify; only time will tell whether the mixture will resist the new computer-based revolution, the changing patterns of leisure and the geographical effects of increasing integration with Europe.

3 (adapted from the Official Handbook of The County of Avon, 2nd edition).

4 Bristol, the regional capital of the South West of England and once the second city in the land, has developed in recent years as the key touring centre for the region.

5 The city is full of historic treasures, spacious colourful parks and miles of waterway.

6 Much of Bristol's thousand years of history is entwined with the sea and seafaring tradition. It was from Bristol that John Cabot set sail in 1497 to discover North America - centuries later William Penn and thousands of settlers followed a similar route to a new land. That spirit of adventure and exploration is at the heart of Bristol's heritage.

7 Bristol has preserved its fine heritage. All around the City are reminders of its links with ths sea. In the old City Docks at the centre of the City can be found the s.s.Great Britain, Brunel's famous iron ship, while spanning the Avon Gorge is Bristol's most famous landmark and testament to Brunel's ingenuity, the Clifton Suspension Bridge.

8 Corn Street, the pulse of Bristol's business houses and the centre of the Old City, has magnificent buildings and the Nails - bronze trading tables where merchants used to "pay on the Nail". Nearby colourful arcades and markets offer the tourist a chance to browse and buy.

9 Well Provided with Education Opportunities.

10 Avon County Council maintains 392 primary schools, 62 secondary schools and 10 higher education establishments which includes Bath College of Higher Education. University education is provided by the University of Bristol, the University of the West of England and the University of Bath.

11 Useful Contacts and Addresses.

12 Local Government Bristol City Council
Council House
College Green
BRISTOL
BS1 5TR

13 Education University of Bristol
Senate House
Tyndall Avenue
BRISTOL
BS8 1TH

14 Tourist Information Bristol Information Centre
Colston House
Colston Street
BRISTOL
BS1 5AQ

15 The Districts of the County of Avon.

	District	Population[1]	Area[2]
16			
17	Bath	84,300	2,872
	Bristol	401,300	10,954
	Kingswood	84,600	4,789
	Northavon	118,900	46,152
	Wansdyke	77,200	32,335
	Woodspring	162,800	37,437

1 as estimated by the Office of Population Censuses and Surveys.
2 in hectares (to convert to acres multiply by 2.471).

SOURCE.DOC(Unformatted)

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Corn Street, the pulse of Bristol's business houses and the centre of the Old City, has magnificent buildings and the Nails - bronze trading tables where merchants used to "pay on the Nail". Nearby colourful arcades and markets offer the tourist a chance to browse and buy.

BRISTOL.DOC

THE CITY OF BRISTOL

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Ancient churches are dotted around the City, while museums abound for visitors. As well as the City of Bristol Museum and Art Gallery there is an up-to-the-minute Industrial Museum on the side of the City Harbour.

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2 in hectares (to convert to acres multiply by 2.471).

Introduction

Word is a word processing package, written by Microsoft, which runs on any IBM-compatible PC. Word is used to create, edit, format and print documents. This document was produced using Microsoft Word.

Word is supplied with a manual (Using Microsoft Word), a reference guide, a pocket guide, a Printer Information manual, keyboard templates and an on-line tutorial called Learning Word.

'Using Microsoft Word' describes Word function by function, that is there are sections on the Word screen, text formatting, form letters etc. The reference guide contains a complete description of the package and its commands. The Pocket Guide and keyboard templates are very useful aide-memoires.

The Learning Word tutorial is very well presented and provides a reasonably good introduction to Word. It takes quite a long time to complete the course although you can choose to do only selected parts.

This document describes version 5 of Word. References A and B describe previous versions, versions 3 and 4. Reference C is a summary of short-cut keys which can be used in Word. Reference D describes printing from Word.

If available, a mouse can be used to select commands, highlight text, manipulate the windows etc. This document does not describe using a mouse; it is fully described in the manuals, with a comprehensive summary in the Pocket Guide. When typing a document, it is probably easier to use the keyboard commands as described here. Using a mouse can be much faster when editing a document.

Running Word

Calling Word

On systems with one floppy disk and one fixed disk which have been set up by the Computing Service, it is recommended that a batch file is created in the directory \BAT to run Word. Reference E describes batch files in detail. Appendix B of this document contains a listing of a batch file suitable for running Word.

Once the batch file has been created, typing:

word

from any directory invokes the package. By default, Word looks in the current directory for document files. Usually a DOS *CD* command should be given before running Word to change directory to a sub-directory where documents are stored (see Reference F for details of directories).

Screen display

Once Word has been called the main Word editing screen is displayed.

The screen is normally divided into two parts - a large **text window** at the top and a smaller **command area** at the bottom. When Word is called, control is in the text window and anything typed is treated as new text. Pressing the Esc key transfers control to the command area. In most cases, once a command has been selected and processed, control is passed back to the text window.

The command area contains a **menu** of command names. Underneath the menu is a **message line** which contains either a brief description of what to do next or, if an error has occurred, a message describing the error. The layout of the command area is:

```
COMMAND:  Copy Delete Format Gallery Help Insert Jump Library
          Options Print Quit Replace Search Transfer Undo Window
Error message or hint
Position    {scrap}                                  Microsoft Word
```

The screen display can be changed to suit individual tastes (see 'Changing the screen display' on page 13).

Quitting from Word

To leave Word, press the Esc key followed by *q* (this is described more fully in 'Using commands' on page 2).

> It is very important to quit from Word at the end of a session. Resetting or switching off the computer without quitting can destroy the document files accessed during the session and also other files on the disk.

It is also important to ensure that floppy disks containing documents are not removed from the disk drive *while any of them are still in use.* To ensure that this is the case, it is advisable always to quit from Word before removing the disk from the drive.

Using commands

Selecting a command

When the Esc key is pressed to transfer control to the command area, the first command in the menu (*Copy*) is highlighted (that is, it is displayed in reverse video).

One way of selecting a command is to use the arrow keys or the Tab key to move the highlight to the name of the command. Once the command name is highlighted, press the Enter key to select the command.

A simpler way of selecting a command is to type the first (capitalised) character of its name (in either lower or upper case). The Enter key is *not* pressed to select a command by this method.

For example, to quit from Word, either highlight the *Quit* command name then press the Enter key, or type *q* to select the *Quit* command.

Once a command has been selected, a further menu of sub-commands might be displayed. Appendix C is a list of Word commands and sub-commands. For example, for the *Format* command, the sub-commands are *Character*, *Paragraph*, *Tab*, *Border*, *Footnote*, *Division*, *Running-head*, *Stylesheet*, *sEarch*, *repLace*, *revision-Marks*, *pOsition*, *Annotation* and *bookmarK*. Selection is the same as for the original command, either by using the arrow keys to highlight the name then pressing Enter, or by typing the capitalised letter in the name (though this is not necessarily the initial letter for sub-commands). Further levels of sub-commands may be displayed.

When the final sub-command has been selected, the command area usually displays a number of fields which can be set to control how the command works (see next section). When all the command fields are set correctly press Enter to execute the command.

Command fields

Command fields contain information needed by the command. Each field consists of a name followed by a colon then the value for the field. When the command fields are displayed, the current value of the first field is highlighted. Use the arrow keys to position the highlight at the command field to be changed. The value of the command field can be one of three types (the message line indicates which):

- an option. These are displayed as a list of possibilities. The currently selected option is highlighted (if the command field is selected) or enclosed in parentheses, for example:

  ```
  ruler:  (Yes) No
  ```

  To change a setting once the command field has been selected, either use the Space bar to position the highlight on the required option, or type the first capitalised character of the option. For example, to change the value of the command field *ruler* to *No*, either press the Space bar or type *n*.

- a decimal number. These may be positive or negative and may include the following units of measurement:

in	Inches
"	Inches
cm	Centimetres
p10	Tenths of an inch
p12	Twelfths of an inch
pt	Points (1/72s of an inch)
li	Lines (sixths of an inch). For vertical measurements only.

  If no unit is typed, it is usually assumed to be inches (though this can be changed, see 'Changing the screen display' on page 13). Some fields expect the value to be in different units. The message line tells you what units will be assumed if you don't include the unit.

- a text string, for example a file name, printer type or text to be searched for. In many cases, pressing the function key F1 displays a list of possible values (for example a list of names of appropriate files) in the text window, one of which can be selected using the arrow keys. This method of selection can be used whenever the words 'select from list' appear in the message line.

To select a new command field after pressing F1 (that is, to move control of the arrow keys back to the command area), press the F1 key again.

Once all the command fields are set as required, complete the command and return to the text window by pressing the Enter key.

Aborting a command

Most commands can be aborted at any time before returning to the text window by pressing the Esc key. The highlight is switched off in the command area. Some commands use the text window to present more information (for example the *Help* and the *Library Spell* commands). Esc does not abort these commands but their menus include an *Exit* command. Type *E* to return to the text window containing the document.

Help

Information about Word can be displayed at any time by selecting the *Help* command. To obtain help about a particular command, first highlight the command (or sub-command) name then hold down the Alt key and type *h*.

Entering and editing text

Moving the cursor

Text is entered at the current cursor position. The cursor is moved using the arrow keys, and the Home, End, PgDn, and PgUp keys, with the Ctrl key giving special meanings to these keys. The Pocket Guide and Chapter 4 of Using Microsoft Word give full lists of the movements caused by these keys.

The arrow keys move the cursor one line up or down, or one character left or right. Other cursor-moving keys are:

Key	Function
Home	beginning of line
End	end of line
Ctrl/Home	top of text area on the screen
Ctrl/End	bottom of text area on the screen
PgUp	previous screenful of document
PgDn	next screenful of document
Ctrl/PgUp	beginning of document
Ctrl/PgDn	end of document

The Backspace key (marked ←, above the Enter key) deletes the character to the left of the cursor. Use Backspace rather than the Del key to delete single characters.

Different kinds of spaces

As text is typed, a new line is started automatically when the end of the line (indicated by a right square bracket,], on the ruler at the top of the screen) is reached. This is known as **word wrap.** If the command field *show non-printing symbols* in the *Options* command is set to *All*, the different characters used to space out text are all displayed as special characters on the screen. These characters are not printed when the document is printed.

- Ordinary spaces between words are represented on the screen by a small dot.
- Non-breaking spaces are used between words which should not be split over two lines nor have filling space inserted between them, such as proper names. They are entered by holding down the Ctrl key and pressing the spacebar (Ctrl/space). Non-breaking spaces are represented on the screen by a blank space.
- Pressing the Enter key indicates the end of a paragraph. It is represented on the screen by a paragraph mark (≡).
- To start a new line without ending the paragraph, hold down the Shift key and press Enter (Shift/Enter). Newline characters are represented on the screen by ↓. The advantage of being able to start a new line without ending the paragraph is that the same format can be maintained over several lines.
- Pressing the Tab key while in the text area inserts a single tab character into the text (represented on screen by →) and has the effect of aligning the following text on the next tab position (see 'Setting tabs' on page 10).
- Special sequences start a new page (Shift/Ctrl/Enter, represented on screen by a row of full stops), a new division (Ctrl/Enter, represented by a row of colons) or a new column (Ctrl/Alt/Enter, also represented by a row of full stops).

Highlighting blocks of text

Many actions, such as formatting or deleting, are carried out on a part of the document which has previously been selected. The selected part is highlighted (displayed in reverse video).

The character at the cursor position is always highlighted. Function keys F6 to F10 select larger blocks of text.

Key	Function
F6	extend selection (see below)
F7	selects the word to the left of the cursor
F8	selects the word to the right of the cursor
F9	selects the previous paragraph
F10	selects the next paragraph
Shift/F7	selects the previous sentence
Shift/F8	selects the next sentence
Shift/F9	selects the line containing the cursor
Shift/F10	selects the whole document

Use F6 to select any block of text:

- position the cursor at the start of the block
- press F6 (to switch on **extend mode** - the characters EX appear in the command area)
- move the cursor to the end of the block (using the cursor-moving keys, function keys F7 to F10, and the *Search* command as required)
- press F6 again (to switch off extend mode)

Alternatively a block of text can be highlighted by holding down the Shift key and moving the cursor using the arrow keys.

Search and replace

The *Search* command searches for specified text from the cursor to the end of the document. If the *direction* field is changed to *Up*, the document is searched from the cursor to the beginning of the document.

Pressing Shift/F4 repeats the last search made and so finds the next occurrence of the text.

Some characters, such as Tab and paragraph mark, cannot be inserted directly into the text string; instead they are represented by special sequences beginning with a caret (^). Special sequences that can be used in the *text* command field of the *Search* command are:

Sequence	Meaning
^s	non-breaking space
^t	tab character
^p	paragraph mark
^n	newline character
^d	page break
^?	question mark
^^	caret (^)
^w	white space (that is any combination of spaces, non-breaking spaces, tabs, paragraph marks, newlines, page breaks)
?	any single character

All but the last two sequences can also be used in the *with text* field in the *Replace* command.

If only a single character is highlighted, the *Replace* command optionally replaces all instances of the specified text between the highlight and the end of the document. Otherwise, only the instances inside the highlighted block are replaced.

Deleting, moving and copying blocks of text

The Del key deletes the currently highlighted text. For example, to delete a sentence from a document:

- move the cursor to somewhere in the sentence
- press Shift/F7 to highlight the sentence
- press the Del key

The deleted text is placed in a store called the scrap (signified in the command area by { }) so that it can be retrieved later. Any text already in the scrap is overwritten.

To delete text without placing it in the scrap, highlight the text, then press Shift/Del.

To move a block of text:

- delete it into the scrap as described above
- move the cursor to the position where the text is to be inserted
- press the Ins key

To copy text:

- select the text to be copied
- choose the *Copy* command (Esc then *c*) to copy to the scrap
- press Enter to execute the command
- move the cursor to where the text is to be copied
- press Ins to insert the text

Glossaries

Blocks of text which are likely to be used frequently may be stored separately in a permanent **glossary**. The *Delete* and *Copy* commands give the option of typing the name of a glossary entry instead of using the scrap. The highlighted text is then stored as an entry in the glossary.

Glossary entries can be retrieved by selecting the *Insert* command and either pressing the function key F1 to display a list of glossary names or typing the name in the *from* command field.

A quicker method of retrieving a glossary entry is to type its name (as a word) in the text and then press the F3 function key. The name must be preceded by a space or a punctuation mark for this method to work.

Several built-in glossary entries are always available.

Name	Inserts
page	the current page number when the document is printed (the text `(page)` appears on the screen).
nextpage	the page number of the following page when the document is printed (the text `(nextpage)` appears on the screen).
footnote	the next footnote number. Used for reinserting accidentally deleted footnote reference numbers.
time	the current time.
timeprint	the time when the document is printed (the text `(timeprint)` appears on the screen).
date	the current date.
dateprint	the date when the document is printed (the text `(dateprint)` appears on the screen).

- The date and time are read from the system clock.

The Transfer Glossary command has sub-commands to delete glossary entries and to save the glossary as a file. Glossary file names normally have the extension .GLY.

Defining the format

Word uses three levels of formatting:

Character	defines the typeface and style of the characters.
Paragraph	defines the alignment of the text, tabs, indentation and line spacing for a paragraph.
Division	defines the size and format of the page and the running heads which appear at the top and bottom of each page (see 'Division format and running heads' on page 11). Usually there is only one division format per document.

Character format

The character format is set using the *Format Character* command. This command has fields to specify whether the highlighted characters are to be bold, italic, underlined, struck through, uppercase, in small capitals, double underlined, superscripted or subscripted, and to change the font (typeface), size and colour. Font changes are not visible on the screen (though the command field *show line breaks* in the *Options* command can be set to *Yes* to show where the line breaks actually occur).

A quicker way of making the characters in a highlighted block bold, italic etc is to use the Alt key in conjunction with a character. The most useful of these key strokes are:

Key	Format
Alt/*b*	bold
Alt/*i*	italic
Alt/*u*	underline
Alt/-	subscript
Alt/+	superscript
Alt/Space	remove all character formatting
Alt/z	remove all character formatting except font name and font size

If a style sheet is attached to the document, (see 'Style sheets' on page 12), the formatting character may have to be preceded by *x* (for example Alt/*xb* to make the highlighted text bold).

If only a single character is highlighted when the Alt sequence is typed, the format is applied to the text typed afterwards (but not to the highlighted character). To change the format of a single highlighted character, the Alt sequence must be typed twice.

Although any of the command fields in the *Format Character* command can be selected, whether they have any effect on the text when it is printed depends on the printer being used. For example, daisy wheel printers can print in italics only if an appropriate print wheel is inserted. The Microsoft Word Printer Information manual and Reference D give more information about printing.

Paragraph format

All text is divided into paragraphs separated by paragraph marks. When inputting text, a new paragraph is started whenever the Enter key is pressed. This is displayed on the screen as a paragraph mark (providing that command field *show non-printing symbols* in the *Options* command has been set to *All* or *Partial*).

Each paragraph has its own format which is associated with the paragraph mark. When two paragraphs are joined by deleting the paragraph mark that separates them, the resultant paragraph has the same format as the second original paragraph.

One way to set up the format for a document is to choose the *Format Paragraph* command and define the paragraph format to be used throughout the document. When the command is executed a paragraph mark with the defined format is inserted.. As long as the text is inserted before this paragraph mark, it is formatted according to the format associated with the paragraph mark.

Paragraphs which are to be formatted differently from the bulk of the document (for example headings, tables) should be formatted when all the document has been typed (to avoid having to redefine the format continually). Headings, for example, should have command field *keep follow* in the *Format Paragraph* command set to *Yes* so that they are kept on the same page as the following text when the document is printed.

Some paragraph formats can be specified without having to use the *Format Paragraph* command by typing a character while holding down the Alt key. The most useful of these are:

Key	Format
Alt/*c*	centred
Alt/*j*	justified
Alt/*l*	left flush (ragged right)
Alt/*r*	right flush (ragged left)
Alt/*2*	double spaced lines
Alt/*p*	remove all paragraph formatting

If a style sheet is attached to the document, (see 'Style sheets' on page 12), the formatting character may have to be preceded by *x* (for example Alt/*xc* to make the highlighted paragraphs centred).

Rules and boxes around paragraphs are drawn using the *Format Border* command. Paragraphs can also have background shading. This is selected using the *background shading* field of the *Format Border* command. The shading level is set as a percentage from 0 (no shading) to 100 (solid black). Background shading is not shown in the text window but is shown by the *Print preView* command.

Although rules, boxes and shading may appear to be correct on the screen they will only be printed correctly if the printer driver (the program which controls the printer) allows them to be printed. See Reference D for more details of printer drivers.

Setting tabs

When typing a table:

- use Tab characters between the columns
- end each line with a newline (Shift/Enter) so that the whole table is a single paragraph
- set command field *keep together* in *Format Paragraph* to *Yes* to ensure that the table is kept on the same page when the document is printed

The alignment of each tab can be:

Left	starting from the tab position.
Right	ending at the tab position.
Center	centred on the tab position.
Decimal	decimal points aligned on the tab position, or right aligned if there is no decimal point.
Vertical	a vertical bar is inserted at the tab position. No tab character is needed.

The leader character, that is the character used to fill the space between the previous column and the one being defined, can be a space, full stop, hyphen or underline.

To set tabs, highlight the text, choose the *Format Tab Set* command, and then, for each tab required:

- specify the position either by typing the measurement (for example 2" for a tab stop 2 inches from the left margin), or by pressing the F1 function key then moving the cursor along the ruler using the right and left arrow keys.
- if you want a leader character, press the appropriate character (., - or _).
- insert the tab position by pressing the letter specifying the alignment (*l*, *r*, *c*, *d* or *v*)

The text is updated accordingly as soon as the tab is inserted.

When all tab positions have been set, press Enter to return to the text area.

The *Format Tab Reset-all* command deletes all tabs.

Individual tabs can be deleted using the *Format Tab Set* command by specifying the tab position then pressing the Del key.

Once tabs have been set and F1 has been pressed, the up and down arrow keys can be used to move to the next defined tab position when setting or deleting tabs.

Division format and running heads

The page size is normally determined by the printer selected for output. If it has not been set up correctly, consult the printer manual for information on the page size expected and set the appropriate fields in the *Format Division Margins* command.

Running heads are paragraphs which appear at the top and bottom of every page. This document has a top running head containing the title of the document, and a bottom running head containing the document number, date of issue and page number.

The distance from the top and bottom of the page that running heads are to be placed is defined in *Format Division Margins* (see Appendix A for a diagram of the page layout).

Running heads can be aligned either with the edge of the paper or with the left margin (see 'Setting tabs' on page 10). They cannot however be extended into the gutter margin (the binding allowance on the inside edge of the paper).

Running heads may be any number of lines long. If a running head is longer than the margin into which it is to be inserted, the margin is increased to accommodate it. Often a running head is only one line long and includes the page number.

The running heads must be typed at the beginning of the division before any other text (even if they are to appear at the bottom of the page). For example, to set a running head which prints the page number surrounded by dashes at the centre bottom of every page of the document:

- insert as the first text in the document:

  - page<F3> -

  Typing the word *page* followed by pressing the F3 key (*<F3>*) inserts the glossary entry 'page' at that position in the running head.
- press Enter to insert a paragraph mark then press the up arrow key to move the cursor into the running head paragraph.
- hold down the Alt key and type *c* (to centre the text, see 'Paragraph format' on page 9).
- choose the *Format Running-head* command.
- set command field *position* to *Bottom* and set all other command fields to *Yes* then press Enter to return to the text area.

A caret (^) appears beside the paragraph (only the one line in this case) to identify it as a running head.

To stop a paragraph appearing as a running head, set the *position* field in *Format Running-head* to *None*.

Footnotes

To insert a footnote, move the cursor to the position in the document where the footnote reference is to be inserted, then give the *Format Footnote* command. If nothing is typed for the command field *reference mark*, the footnote is automatically numbered. Otherwise, the reference mark typed is used.

After pressing the Enter key to execute the *Format Footnote* command, type the text for the footnote.

The footnote text is shown after the end of the document (although footnotes may be printed either on the same page as their reference mark or at the end of the document).

Use the *Jump Footnote* command to jump between the footnote and the main text.

Deleting the footnote reference mark in the document also deletes the text of the footnote.

Style sheets

Style sheets are sets of formats or **styles** which can be applied to any document. They are stored in files with the suffix .STY and created and edited using the *Gallery* command. The use of a style sheet helps to keep a consistent format in all the documents to which it is attached. Style sheets also allow the format of documents to be changed very easily. For example, different style sheets could be attached to a document to prepare a draft or a final version.

Each style has a user-defined **code**, one or two characters long, which is used to apply the style to text, and a **variant** chosen from a predefined list, which is used by Word to identify the style. Most variants are numbers but some have names to indicate their function, for example 'Heading level 1'.

The two most important variants are the Standard Paragraph and the Standard Division. The Standard Paragraph defines the paragraph and character formats that are used if no others are specified for the text. Similarly, the Standard Division defines the division format to be used by default.

To attach a style sheet to a document, use the *Format Stylesheet Attach* command. The standard division and standard paragraph styles are applied automatically when the style sheet is attached.

To apply a particular style, select the text to be formatted, then hold down the Alt key and type the one or two character code. If the *show style bar* field in the *Options* command is set to *Yes*, the code for the current paragraph format is displayed to the left of the text. To display a list of styles, use the *Format Stylesheet* command, then choose the *Division*, *Paragraph*, or *Character* sub-command and request a list by pressing the F1 function key.

When the style sheet is edited using the *Gallery* command, the format of the document to which it is attached is changed immediately.

> Any formatting done using the *Format* command overrides the style sheet formatting.

Formatting characters and paragraphs using the Alt sequences described in 'Character format' and 'Paragraph format' can still be done once a style sheet is attached. The character code must be preceded by *x* if there is any conflict between the names of the styles and the Alt sequences. For example, to make the highlighted characters bold, hold down Alt and type *xb*.

Changing the screen display

The screen display can be changed using the *Options* command. Most of the settings of this command are retained between runs of Word. They are independent of the document being edited.

The *Options* command controls the amount of information shown in the text area. Setting the command field *show non-printing symbols* to *All* causes all characters typed, including tabs, newlines, paragraph marks and spaces, to be represented distinctively on the screen. This can be useful especially when a document prepared on a different system or package is being edited.

The command field *show line breaks* is usually left as *No.* The document is displayed as it would be printed on a printer using a 12 point fixed pitch font (for example, Courier 12). It can be useful to set *show line breaks* to *Yes* when a proportional font (such as TMSRMN) or a different font size is being used so that you can see where line breaks will occur when the document is printed. See Reference D for more about printing in different fonts.

The command field *measure* is usually set to *In* or *Cm* to display measurements in either inches or centimetres. When using a 10 point fixed pitch font (which is the equivalent of a 12 pitch typeface on a typewriter), it is sometimes convenient to set *measure* to *P12*. The text is then displayed as if it were 12 pitch characters instead of the default which is to display it as though it were 10 pitch.

The command field *display mode* controls how different formatted characters are displayed on the screen. Press F1 for a list of modes available. The modes are either Text or Graphics. Text modes make scrolling through documents noticeably faster, particularly when a large document is being edited. However, in these modes, any text which has been set to italic, bold etc is displayed as underlined on monochrome screens or in colour on colour screens. In Graphics modes specially formatted text is shown on the screen in that format.

The command field *summary sheet* is set to *Yes* by default. The effect of this setting is to request information about a document (its title, author, keywords etc) when it is saved for the first time. The summary sheet information can be updated and used later by the *Library Document-retrieval* command to find documents, for example with a particular author. Summary sheets can be extremely useful but are not relevant to everyone's needs. If they are not being used, set *summary sheet* to *No.*

The command field *show ruler* turns the display of a ruler in the top margin on and off. When *show ruler* is set to *Yes* the left and right margins and the tab settings are always on view.

Saving, loading and printing files

Documents are saved using the *Transfer Save* command. If no extension is given for the filename, the extension .DOC is used (see Reference E for a description of filenames). If the command field *format* is set to *Text-only* or *Text-only-with-line-breaks*, the document is stored as a standard ASCII file without any formatting information (necessary, for example, when creating a batch file, see Appendix B and Reference E).

The directory used if none is specified is set in the *Transfer Options* command. The directory is initially set to the working directory, that is the directory in use when Word was called.

To read in a document already stored, use the *Transfer Load* command. A list of files stored in the default directory with the extension .DOC is displayed when the function key F1 is pressed. To display a list of all files in the default directory, type *.* in the *filename* command field, then press F1.

If Word runs short of memory a message SAVE is displayed at the bottom of the command area. If the SAVE message starts flashing, action must be taken. Try the following, until the message disappears:

- copy a single character to the scrap (Esc followed by *c* then press Enter).
- save the document.
- choose *Transfer Clear All* to clear the document, then reload it with the *Transfer Load* command.

The type of printer is set in the *Print Options* command. The printer options are saved from session to session and so need not normally be changed except when more than one printer is available. Reference D describes printing from different printers.

To find out where the page breaks will occur when the document is printed, use the *Print Repaginate* command and set the command field confirm to *Yes*.

If the *Options* command field *paginate* is set to *Auto* page breaks are always displayed where they will occur. Page breaks are shown as a dotted line across the screen.

The *Print preView* command can be used to see how the document will look when printed. Although the text is not clear enough to be read, the overall page layout can be seen showing running heads, footnotes etc. The PgUp and PgDn keys can be used to move through the document. The *Exit* command is used to return to the main text window.

The *Print Printer* command prints the document.

Preparing files for transfer to other systems

If you are using Word to prepare a file for use on a different computer, for example a message you want to send as electronic mail, you should save it without any Word formatting commands. To save a file as a straightforward text file, with carriage returns at the end of every line and no page throws, headers or footers:

- choose the *Format Division* command.
- set the left, right, top and bottom margins to zero.
- delete any running heads.
- set the page width to the maximum line length required (assuming 10 characters/inch, for example 8 inches for a maximum of 80 characters).
- choose the *Format Division Layout* command and set the field *footnotes* to *End* (if there are any footnotes).
- save the file using the *Transfer Save* command with *format* set to *Text-only-with-line-breaks.*

Reference G describes how to transfer a file from a PC to another computer.

Note that pound signs (£) are not accepted as characters by multi-user computer systems and should be deleted before transferring the file as they can cause unpredictable errors.

References

A. Introduction to Microsoft Word version 3 on PCs
Document D3.1

B. Introduction to Microsoft Word version 4 on PCs
Document D3.2

C. Key combinations in Microsoft Word version 5
Document D3.6.2

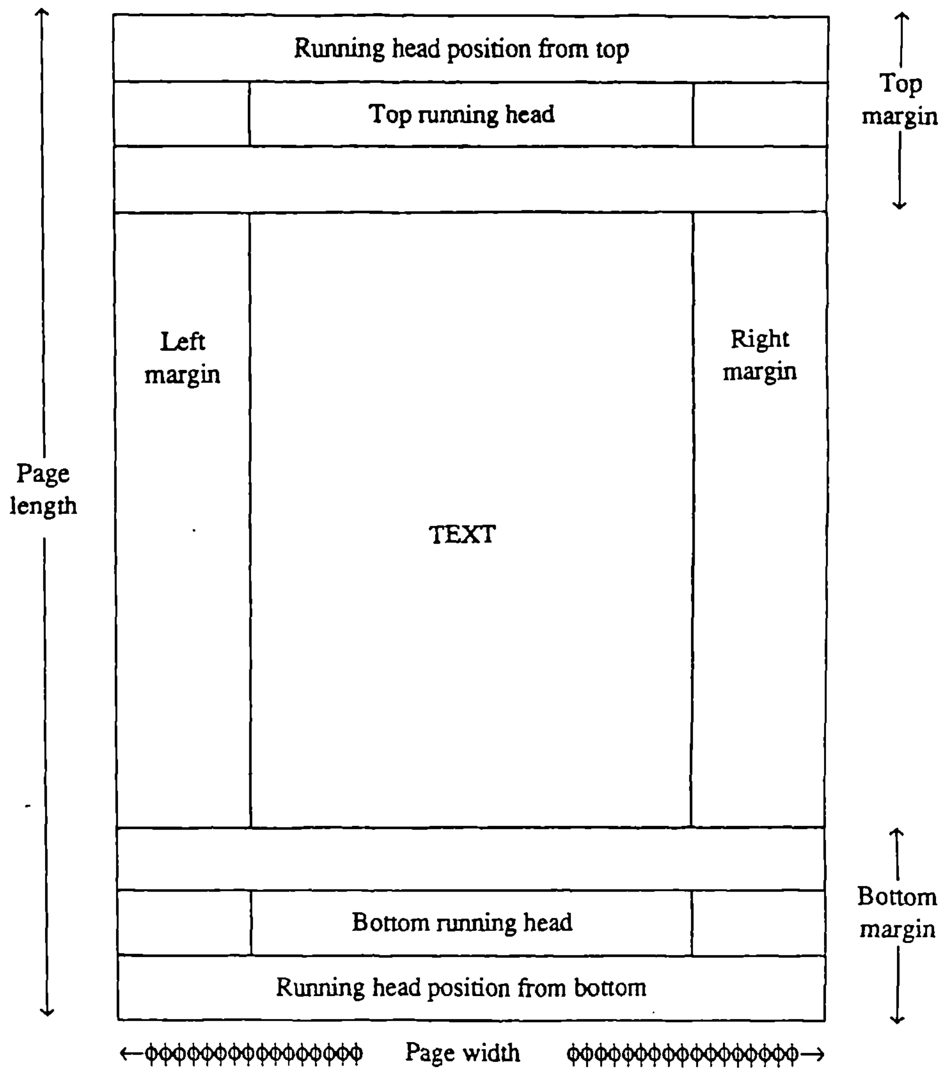
D. Printing documents from Microsoft Word version 5
Document D3.6.3

E. DOS batch files
Document D1.3

F. Introduction to the Disk Operating System (DOS) for PCs
Document D1.1

G. Using Kermit for terminal emulation and file transfer
Document J3.1

Appendix A
Page layout



There may also be a gutter margin which runs down the entire inside edge of the page (that is the left side on odd-numbered pages and the right side on even-numbered pages).

Running heads can be aligned with the left and right margins or with the edge of the paper.

Appendix B
Batch file for running Word

The file listed below is suitable for running Word on systems set up by the Computing Service. The batch file PUSHENV.BAT which is called in the first line may not be available on systems obtained elsewhere. The batch file POPENV.BAT which is called in the last line is created by PUSHENV.BAT. See Reference F for full details of what the batch file does.

The file is most easily created in the directory \WORD5 using Word. It should be saved as a text-only file named WORD.BAT. After quitting from Word, copy the file to the directory \BAT using the command:

copy word.bat \bat

After the batch file has been copied, it should be deleted from the \WORD5 directory using the command:

del word.bat

Word can then be called from any directory by typing *word.*

By default, Word looks for files to load and saves files in the directory from which it was called.

Listing of WORD.BAT

```
REM WORD.BAT - calls Microsoft Word if Word is installed in directory
\WORD5
REM           and WORD.BAT is in \BAT
REM
COMMAND /C PUSHENV
ECHO OFF
CLS
PATH=C:\WORD5;C:\BAT;C:\BIN;C:\USR\BIN
\WORD5\WORD  %1 %2
POPENV
```

Appendix C
List of Word commands

Only the commands in the main menu and their sub-commands are listed here. Many sub-commands also have sub-commands. Consult the Microsoft Word Reference Manual for further details.

Copy
- copies highlighted text to the scrap or to a glossary.

Delete
- deletes highlighted text and saves it in the scrap or to a glossary.

Format
- Annotation
  - inserts an annotation mark in the document. Annotation marks are special forms of footnotes used to put comments into documents.
- bookmarK
  - gives the highlighted text a bookmark name.
- Border
  - draws horizontal and vertical rules and boxes around the current or highlighted paragraphs.
- Character
  - shows and sets character format for the highlighted character(s).
- Division
  - shows and sets page formatting for the current or highlighted division.
- Footnote
  - inserts a footnote or changes the reference mark of an existing footnote.
- Paragraph
  - shows and sets paragraph format for the current or highlighted paragraphs.
- pOsition
  - allows a paragraph of text to be placed at a specified position on the page.
- repLace
  - searches for and optionally replaces a character, paragraph or style format.
- revision-Marks
  - marks insertions and deletions in a document.
- Running-head
  - marks the highlighted text as a running head and sets the position of the running head.
- sEarch
  - searches for a character, paragraph or style format.
- Stylesheet
  - attaches a style sheet to the document containing the highlighted text, shows and assigns the character, paragraph and division styles of the highlighted text, or records the current format as a style format.
- Tab
  - shows, sets and clears tabs.

Gallery
moves to the Gallery menu to allow creation and editing of style sheets. Gallery menu commands are not listed here; most of them are very similar to commands in the main menu.

Help
provides help about Word. Help about a particular command can be obtained by highlighting the command then typing Alt/*h*.

Insert
inserts a copy of the scrap or a glossary entry.

Jump
- Annotation
  jumps to an annotation reference mark or to its associated text.
- bookmarK
  jumps to a bookmark.
- Footnote
  jumps to a footnote reference mark or to its associated footnote.
- Page
  jumps to the first line of the specified page.

Library
- Autosort
  sorts text alphanumerically or numerically.
- Document-retrieval
  searches, retrieves, stores and edits document summary sheets.
- Hyphenate
  inserts optional hyphens in the active document.
- Index
  compiles designated entries into an index placed at the end of the current document.
- Link
  imports document, spreadsheet and graphics files.
- Number
  numbers headings, subheadings and paragraphs automatically.
- Run
  runs other programs or DOS commands without quitting from Word.
- Spell
  checks the spelling of words in the active document.
- Table
  compiles designated entries into a table of contents placed at the end of the current document.
- thEsaurus
  finds synonyms of words.

Options
shows and sets Window Options (for example whether style bar, ruler, colours are displayed) and General Options, (which alter the amount of information displayed on the screen). The settings are carried over to the next session of Word and are not associated with the document being edited.

Print
- Direct
  sends all keystrokes directly to a printer until cancelled by Esc.
- File
  saves the formatted output in a file. Useful for creating a file which can be sent to a printer later.

Glossary
prints the contents of the currently loaded glossary.
Merge
sends (to a printer or file) multiple copies of a document such as a form letter, using special fields which are filled from a separate data file or from the terminal.
Options
shows and sets the printer options, including the name of the printer to be used and the port to which it is connected.
preView
shows what the document will look like when printed.
Printer
prints the document. Can be cancelled with Esc.
Queue
begins, pauses, restarts or stops queued printing from the beginning of the queue when option queued in Print Options is set to Yes.
Repaginate
repaginates the document without printing it.

Quit
exits from Word.

Replace
searches for and optionally replaces specified text.

Search
searches for the next occurrence of specified text.

Transfer
Allsave
saves the active documents, style sheets and glossary files to disk.
Clear
clears all or a single text window, closes files and erases the scrap.
Delete
deletes a file from a disk.
Glossary
removes glossary names, loads glossaries from disk, merges glossaries from disk with glossaries already read in to Word, or saves glossaries on disk.
Load
loads a document from a disk file into the active window.
Merge
inserts text from a disk file in front of the cursor.
Options
shows and sets the default drive and directory for disk files.
Rename
renames the disk file of the active document.
Save
saves the active document on disk.

Undo
reverses the effect of the latest revision (including Undo).

Window
Close
closes a window.
Move
moves the window borders to change the size of a window.

Key combinations in Microsoft Word version 5

Function Keys

F1	Select next window
Shift/F1	Undo last edit
Ctrl/F1	Zoom window on/off
Alt/F1	Set tab
F1 in command fields	List field choices
F2	Calculate
Shift/F2	Outline view on/off
Ctrl/F2	Format as header
Alt/F2	Format as footer
F3	Expand glossary entry name
Shift/F3	Record macro on/off
Ctrl/F3	Step macro
Alt/F3	Copy to scrap
F4	Repeat last edit
Shift/F4	Repeat search
Ctrl/F4	Toggle case
Alt/F4	Show layout
F5	Turn overtype on/off
Shift/F5	Outline organise
Ctrl/F5	Line draw
Alt/F5	Go to page
F6	Extend selection on/off
Shift/F6	Column selection on/off
Ctrl/F6	Open thesaurus
Alt/F6	Spell checker
F7	Previous word
Shift/F7	Previous sentence
Ctrl/F7	Load document
Alt/F7	Show line breaks
F7 in command fields	Previous word
F8	Next word
Shift/F8	Next sentence
Ctrl/F8	Print
Alt/F8	Font name
F8 in command fields	Next word
F9	Previous paragraph
Shift/F9	Current line
Ctrl/F9	Print preview
Alt/F9	Text/graphics mode
F9 in command fields	Next character
F10	Next paragraph
Shift/F10	Whole document
Ctrl/F10	Save document
Alt/F10	Record style
F10 in command fields	Previous character
F11 in outline mode	Collapse heading
Shift/F11	Collapse body text
F12 in outline mode	Expand heading
Shift/F12	Expand body text

Character Formatting[1]

Alt/b	Bold
Alt/d	Double underline
Alt/e	Hidden
Alt/i	Italic
Alt/k	Small caps
Alt/s	Strikethrough
Alt/u	Underline
Alt/z	Normal except font and size
Alt/+ or =	Superscript
Alt/- (minus)	Subscript
Alt/Spacebar	Normal character

Paragraph Formatting[1]

Alt/c	Centered
Alt/f	First line indent
Alt/j	Justified
Alt/l	Left aligned
Alt/m	Reduce left indent
Alt/n	Increase left indent
Alt/o	Open paragraph spacing
Alt/p	Normal paragraph
Alt/q	Indent left and right
Alt/r	Right aligned
Alt/t	Hanging indent
Alt/2	Double spacing

Special Characters

Enter	New paragraph
Shift/Enter	New line
Ctrl/Shift/Enter	New page
Ctrl/Enter	New division
Ctrl/-	Optional hyphen
Ctrl/Shift/-	Non-breaking hyphen
Ctrl/Spacebar	Non-breaking space

Other Keys

Esc	Move between text/menu
Ctrl/Esc	Return to main menu
Alt/h [1]	Help
Backspace	Delete character to left
Del	Delete selected text to scrap
Shift/Del	Delete selected text without saving to scrap
Ins	Insert characters from scrap
Shift/Ins	Replace highlighted text with contents of scrap
Ctrl/>	Next form field
Ctrl/<	Previous form field

---

1 Precede the code with Alt/x when a style sheet is attached.

For	Press
New paragraph	Enter
New line	Shift/Enter
New page	Ctrl/Shift/Enter
New division	Ctrl/Enter
Optional hyphen	Ctrl/-
Nonbreaking hyphen	Ctrl/Shift/-
Nonbreaking space	Ctrl/Spacebar

To move cursor	Press
Left	←
Right	→
Up	↑
Down	↓
Beginning of line	Home
End of line	End
Beginning of previous word	Ctrl/←
Beginning of next word	Ctrl/→
Beginning of paragraph	Ctrl/↑
Beginning of next paragraph	Ctrl/↓
Beginning of document	Ctrl/PgUp
End of document	Ctrl/PgDn

Windows	
Top of window	Ctrl/Home
Bottom of window	Ctrl/End
Up a screen	PgUp
Down a screen	PgDn
Select next window	F1
Zoom/Unzoom	Ctrl/F1

To select text	Press
Extend selection on/off[2]	F6
Column selection on/off	Shift/F6
Word left	F7
Word right	F8
Previous sentence	Shift/F7
Next sentence	Shift/F8
Current line	Shift/F9
Previous paragraph	F9
Next paragraph	F10
Whole document	Shift/F10

To delete	
Character left	Backspace
Selected text to scrap	Del
Selected text without changing scrap	Shift/Del

To insert	Press
Contents of scrap	Ins
Scrap to replace selection	Shift/Ins
Glossary entry text	Glossary entry name, F3

Macros	
Record a macro	Shift/F3
Run a macro	F3
Step through macro	Ctrl/F3

To edit responses in command field	Press
Word left	F7
Word right	F8
Character left	F9
Character right	F10
Delete to left	Backspace
Delete highlighted part	Del

Character formatting	Press[3]
Bold	Alt/b
Italic	Alt/i
Underline	Alt/u
Double underline	Alt/d
Strikethrough	Alt/s
Small caps	Alt/k
Superscript	Alt/+ or =
Subscript	Alt/- (minus)
Standard character	Alt/spacebar
Standard except font and size	Alt/z
Hidden text	Alt/e
Change case of characters	Ctrl/F4

Paragraph formatting	Press[3]
Left aligned	Alt/l
Centred	Alt/c
Right aligned	Alt/r
Justified	Alt/j
Widen left indent by a tab	Alt/n
Reduce left indent by a tab	Alt/m
Indent first line by a tab	Alt/f
Left and right indents	Alt/q
Double line space	Alt/2
1 line space before paragraph	Alt/o
Standard paragraph	Alt/p
Widen hanging indent by a tab	Alt/t
Set tab	Alt/F1

To format page	Press
Create header (not first page)	Ctrl/F2
Create footer (not first page)	Alt/F2
Show line breaks	Alt/F7
Show layout	Alt/F4
Print preview	Ctrl/F9

Shortcut Keys	Press
Repeat last edit	F4
Repeat search	Shift/F4
Get help	Alt/h[2]
Calculate	F2
Undo last edit	Shift/F1
Turn overtype on/off	F5
Copy to scrap	Alt/F3
Change font	Alt/F8
Go to page	Alt/F5
Load a document	Ctrl/F7
Save a document	Ctrl/F10
Print a document	Ctrl/F8
Record a style	Alt/F10
Open thesaurus	Ctrl/F6
Check spelling	Alt/F6

2 Alternatively, hold down the Shift key and press an arrow key (though this does not work on all keyboards).

3 Precede the code with Alt/x when a style sheet is attached.

APPENDIX 2

ENTERING CHARACTERISTICS QUESTIONNAIRE (ECQ)

QUESTIONNAIRE FOR NEW UNIVERSITY SECRETARIAL STAFF

Please complete this questionnaire and return it to:

Sally Barnes
School of Education, Research Support Unit
35 Berkeley Square

Name ____________________ ________________________
First Name Last Name

Department ________________________

How old are you?

Under 20	___
20-25	___
26-30	___
31-35	___
36-40	___
41-45	___
46-50	___
Over 50	___

How long have worked in secretarial posts?

Full-time: Years ___ Months ___

Part-time: Years ___ Months ___

How long have you been employed in the University?

Full-time: Years ___ Months ___

Part-time: Years ___ Months ___

What kinds of typewriters have you used in your work?

	Have used in the past	**Use currently**
Manual typewriter	___	___
Electric typewriter	___	___
Electric typewriter with memory	___	___
Other (please specify)	___	___

____

What kinds of typing jobs do you carry out on a typewriter?
(Tick as many as apply)

Envelopes ___
Short letters/Memos ___
Tables/lists ___
Manuscripts ___
Transcripts ___
Filling in forms ___
Other (please specify) ___
____

What is your approximate typing speed (words per minute)? ________

Have you used a computer in your work? (Tick as many as apply)

No ___

IBM PC or PC compatible
(eg Opus, Vanilla, Tandon) ___

Standalone wordprocessor
(eg Rank Xerox) ___

Apple (eg Apple Mac) ___

Amstrad ___

Other (please specify) ___
____

In your work, what activities have you used a computer/word processor for? (Tick as many as apply)

None ___

Word Processing ___

Accounting/Book Keeping
(spreadsheets) ___

Information storage and
retrieval (database) ___

Statistical analyses ___

Programming ___

Other (please specify) ___
____

How much tuition have you received for using computers and word processors? [DOS = Disk Operating System (File handling);
WP = Word Processing]

	RECEIVED DOS	RECEIVED WP	NEEDED DOS	NEEDED WP
None	___	___	___	___
0-2 hours	___	___	___	___
2 hours - 1 day	___	___	___	___
1 - 2 days	___	___	___	___
2 - 5 days	___	___	___	___
5 - 10 days	___	___	___	___
One Term	___	___	___	___
More	___	___	___	___

How familiar are you with each of the following computing terms?

	Completely familiar	Fairly familiar	Not at all familiar
Wordwrap	___	___	___
Floppy disk	___	___	___
Filename	___	___	___
C drive	___	___	___
Format	___	___	___
WORD	___	___	___
Hard boot	___	___	___
CTRL	___	___	___
Directories	___	___	___
Backup	___	___	___

How useful do you think the following instructional techniques would be in helping you learn to use computers?

	Very useful	Useful	Not at all useful
Practical sessions	___	___	___
Lectures	___	___	___
Group Discussion	___	___	___
Individual tuition	___	___	___
Instruction Manuals	___	___	___
Textbooks	___	___	___
Step-by-step	___	___	___
Other books	___	___	___
Videos	___	___	___
Other	___	___	___

(please specify) ______________________

Do you think you **gain** any skills by using a computer/word processor?

Yes ___ No ___ Don't Know ___

If yes, please name them in the space below.

Do you feel you **lose** any skills by using a computer/word processor?

Yes ___ No ___ Don't Know ___

If yes, please name them in the space below.

What do you think you will **like most** about using a computer/word processor in your work?

What do you think you will **like least** about using a computer/word processor in your work?

Thank you very much for taking the time and effort to complete the questionnaire.

Sally Barnes

APPENDIX 3

APPROACHES TO LEARNING QUESTINNAIRE (ALQ)

APPROACHES TO LEARNING QUESTIONNAIRE

NAME ______________________________

Please answer each item quickly giving your immediate response. Put a tick in the appropriate place to show your general approach to learning. **There are no right or wrong answers.**

	Definitely agree	Agree	Neutral	Disagree	Definitely Disagree
In order to make sense of new things I relate them to what I already know	___	___	___	___	___
I find I have to concentrate on memorizing a good deal of what I have to learn	___	___	___	___	___
I generally put a lot of effort into trying to understand things that initially seem difficult	___	___	___	___	___
The continual pressure of work - deadlines, competing tasks - often makes me tense and depressed	___	___	___	___	___
The best way to understand technical jargon is to remember the text-book definition	___	___	___	___	___
I usually set out to understand thoroughly how something works in order to learn how to use it	___	___	___	___	___
I'm so worried I might damage the computer that it disrupts my learning how to use it	___	___	___	___	___

	Definitely agree	Agree	Neutral	Disagree	Definitely Disagre
An interesting job is more important to me than one which pays well	___	___	___	___	___
When I'm learning something new, I often ask myself questions about it which the new information should answer	___	___	___	___	___
I try to memorize important facts which may come in useful later	___	___	___	___	___
I usually don't have time to think about the implications of what I am learning	___	___	___	___	___
I often find myself questioning things that I hear or read about when I'm learning	___	___	___	___	___
Learning to use a computer will open a whole new world for me	___	___	___	___	___
I find it difficult to 'switch tracks' when working on one problem if other things are demanded of me	___	___	___	___	___
I will consider learning anything if it will get me a promotion	___	___	___	___	___
Often I find I have to read instructions without really being able to understand them	___	___	___	___	___
I'm anxious about the idea of having to use a computer at work	___	___	___	___	___
I enjoy figuring out how to use some equipment in a new way	___	___	___	___	___

APPROACHES TO LEARNING QUESTIONNAIRE

		MEAN	SD	MED	MODE	RANGE
In order to make sense of new things I relate them to what I already know	**deep1**	3.13	.85	3	3	1-4
I generally put a lot of effort into trying to understand things that initially seem difficult	**deep2**	3.16	.78	3	3	1-4
I usually set out to understand thoroughly how something works in order to learn how to use it	**deep3**	2.32	1.19	3	3	0-4
When I'm learning something new, I often ask myself questions about it which the new information should answer	**deep4**	2.8	.71	3	3	2-4
I often find myself questioning things that I hear or read about when I'm learning	**deep5**	2.74	.86	3	3	1-4
I find I have to concentrate on memorizing a good deal of what I have to learn	**surf1**	2.74	.93	3	3	0-4
The best way to understand technical jargon is to remember the text-book definition	**surf2**	1.42	.92	1	1	0-3
I try to memorize important facts which may come in useful later	**surf3**	2.94	.89	3	3	1-4
I usually don't have time to think about the implications of what I am learning	**surf4**	2.03	.88	2	3	1-3
Often I find I have to read instructions without really being able to understand them	**surf5**	2.48	1.03	3	3	1-4
The continual pressure of work - deadlines, competing tasks - often makes me tense and depressed	**trait1**	1.74	1.03	1	1	0-4

		MEAN	SD	MED	MODE	RANGE
I find it difficult to 'switch tracks' when working on one problem if other things are demanded of me	**trait2**	1.94	1.24	1	1	0-4
I'm so worried I might damage the computer that it disrupts my learning how to use it	**state1**	.77	.92	1	0	0-3
I'm anxious about the idea of having to use a computer at work	**state2**	.77	.85	1	1	0-3
An interesting job is more important to me than one which pays well	**ext1**	2.90	.87	3	3	1-4
I will consider learning anything if it will get me a promotion	**ext2**	1.7	.95	1	1	0-4
Learning to use a computer will open a whole new world for me	**int1**	2.87	.89	3	3	1-4
I enjoy figuring out how to use some equipment in a new way	**int2**	3.0	.63	3	3	2-4

APPENDIX 4

CONDITIONS FOR LEARNING QUESTINNAIRE (ALQ)

CONDITIONS FOR LEARNING QUESTIONNAIRE

Name ______________________________________

Please answer each item quickly giving your immediate response. Put a tick in the appropriate place to show your level of agreement about your **current post. There are no right or wrong answers.**

	Definitely agree	Agree	Neutral	Disagree	Definitely Disagree
I feel confident organizing the office as I think best	___	___	___	___	___
Nothing I have learned before is helping me master this computer	___	___	___	___	___
I have time to try and learn how to use the computer	___	___	___	___	___
I feel confident in turning on the computer and having a go	___	___	___	___	___
I know what I am expected to be able to do using the computer	___	___	___	___	___
Other people in the office are quite helpful when I get stuck on something when using the computer	___	___	___	___	___
I'd rather turn on the computer and 'have a go' than wait for someone to show me how	___	___	___	___	___

	Definitely agree	Agree	Neutral	Disagree	Definitely Disagree
It is very difficult to follow instructions in the computer manuals	___	___	___	___	___
I feel a great deal of pressure to master the computer quickly	___	___	___	___	___
I know how to go about gaining the computer skills I need	___	___	___	___	___
I never feel nervous about trying out new things	___	___	___	___	___
When I feel overwhelmed by the job there is no one in authority who helps me	___	___	___	___	___
Using a computer is similar to using typewriter	___	___	___	___	___
I know what I have to learn to be able to use the computer reasonably well	___	___	___	___	___

CONDITIONS FOR LEARNING QUESTIONNAIRE

		MEAN	SD	MED	MODE	RANGE
I feel confident organizing the office as I think best	**auto1**	3.0	.730	3	3	1-4
I feel confident in turning on the computer and having a go	**auto2**	3.32	.60	3	3	2-4
Nothing I have learned before is helping me master this computer	**past1**	3.03	.669	3	3	1-4
Using a computer is similar to using typewriter	**past2**	1.25	.89	1	1	0-3
I have time to try and learn how to use the computer	**phys1**	1.97	1.19	2	1	0-4
I feel a great deal of pressure to master the computer quickly	**phys2**	1.71	1.0	2	1	0-3
I know what I am expected to be able to do using the computer	**goal1**	2.65	.80	3	3	1-4
I know what I have to learn to be able to use the computer reasonably well	**goal2**	2.97	.61	3	3	1-4
Other people in the office are quite helpful when I get stuck on something when using the computer	**mutl1**	3.16	.74	3	3	1-4
When I feel overwhelmed by the job there is no one in authority who helps me	**mutl2**	2.79	.98	3	3	0-4
I'd rather turn on the computer and 'have a go' than wait for someone to show me how	**actv1**	2.77	.76	3	3	1-4
I never feel nervous about trying out new things	**actv2**	1.94	1.03	2	1	0-4
It is very difficult to follow instructions in the computer manuals	**learn1**	2.41	1.15	2	1	1-4
I know how to go about gaining the computer skills I need	**learn2**	3.03	.61	3	3	1-4

APPENDIX 5

INSTRUCTIONS FOR KEEPING A DIARY

INSTRUCTIONS FOR KEEPING A DIARY

I need to ask you to keep track of the amount of time you spend using Word 5 during the course of the study. I hope this won't be a difficult or time consuming task for you, but it's important for me to know how much time you spend using the computer. That way I can take in to account the different amounts of time you each spend on the computer from day to day or week to week.

What I'm really interested in is how much time you spend typing in documents - just bashing them in. And how much time you spend editing or modifying documents. As you know there's a big difference between typing in a draft and correcting or editing that draft.

I have sheets for you to keep the information on. I don't need to know what the document is or what it is about just are you typing it in new or modifying. For the start and finish times it is too much to expect you to look at the time so often, but keep an eye on how long you are spending on each job. If you stop because you have finished then put finished. If you stop because it's lunchtime or the end of the day then put that. If you stop and start because of interruptions those don't need to count as stops but you might want to note down that you were interrupted frequently.

If you have any problems or questions try and write down as much as you can about the problem and any messages you have on the screen. That way when I come next week we can try and figure out what went wrong and how to avoid it happening again. If there are things you want help with doing, write down those things as a reminder for when I come next time.

If you happen to go on any courses or use the Learn program or read the documentation just note it down. Each of these activities may change how you do things and that will make a difference when you do the editing tasks for me.

DATE	TIME START	TIME FINISH	MAIN ACTIVITY	REASON FOR STOPPING	PROBLEMS	COURSE ATTENDENCE	USING LEARN	DOCUMENTATION

APPENDIX 6

DETAILS FOR PRE-EXPERIMENTAL SESSION 1

PRE-EXPERIMENTAL TASK 1

TURNING ON COMPUTER DOS, ENTERING/EXITING WORD

What I want to find out today is what you already know how to do on the computer? This way I will have an idea about how much you know. Some people will know what to do because they've done it before; you might know things because you've watched other poeple do them but not tried them yourself. So I'm going to ask you about what you can do to see where we are starting from. This isn't a test and there is no good or bad performance. OK? Any questions?

1. First of all have you used a computer before and can you tell me what type of computer it was?

2. How long did you use it?

3. What were the main things you did on the computer?

4. Did you receive any training to use that computer or how did you learn to use it?

REPEAT asking about other computers used.

5. What do you think your major computer activities wil be using ths PC computer?

6. What training and/or support do you expect to receive?

7. Do you know how to turn the PC computer on and what should appear on the screen if everything has started up properly? Can you do that for me know please.

8. You have probably heard the term DOS. Do you know what it refers to?

9. What things can you do when the C\:> is showing - what DOS commands do you know? Can you show me.

10. Can you tell me about the things you have done using other kinds of computers.

11. You are learning how to use the computer for word processing. I wonder if you have used the LEARN program. Can you tell me what you do when you go to use it? What do you type in and what happens next? We won't go into the program because as you know it is difficult to get out of it!

12. Do you know how to get into the wordprocessing package? What is the command you type? Can you do that for me know please?

13. Do you know how to get back to the C\:> from WORD. Can you do that for me now.

GREAT. That's all I wanted to ask you to do today. Now I have an idea about what you know about computers and what experience you have.

TASK 1

PREVIOUS COMPUTER USE

TYPE: ________ ________ ________

LOCATION: ________ ________ ________

LENGTH OF USE: ________ ________ ________

ACTIVITIES: ________ ________ ________

TRAINING: ________ ________ ________

PC USE

LENGTH OF USE: ________

LOCATION: ________

ACTIVITIES: ________

TRAINING: ________

TASK	KNOWLEDGE		ACTION		COMMENT
Turn on Computer	YES	NO	YES	NO	
Definition of DOS	YES	NO	YES	NO	
Knowledge of C prompt	YES	NO	YES	NO	
C hard disk	YES	NO	YES	NO	
PC COMMANDS					
Knowledge LEARN	YES	NO	YES	NO	
ENTER WORD	YES	NO	YES	NO	
EXIT WORD	YES	NO	YES	NO	

NAME:______________________________ DATE:________________

APPENDIX 7

DETAILS FOR EXPERIMENTAL SESSIONS 1 - 4

EXPERIMENTAL TASK 1

WORD EDITING TECHNIQUES

Now that you have been on the WORD course you probably have a bit better idea of what word processing is all about. I've brought a document on floppy disk which needs to be edited. As you are probably already well aware one of the main advantage of word processing over typing is that instead of typing it all in again you can edit what you typed in before. So we need to make some changes to the document I've brought.

1. First of all, can you turn the computer on please?

2. Can you enter WORD please.

3. Now we need to load the text file from floppy disk. Do you know how to do that? Do you know what the commands are to load a file? And what extra instruction do you need to load a file from floppy disk? The file is called POLLTAX.DOC. Can you load it into WORD now please.

4. The first thing we need to do with the document is to add a new paragraph to the bottom of the text. Can you do that for me now, please?

5. There are some changes I want you to make to the file. Can you find the last sentence of the first paragraph which begins **Teachers' salaries make up.** Change make up to account.

6. In the first paragraph, the second to last sentence which begins **It is not a new idea...** Find the words **much to** and change it to **much superficially to**

7. The word **saleries** should be spelled **salaries** throughout.

8. We need to divide paragraph one into two paragraphs. The new paragraph should begin with the sentence **It is not a new idea**

9. In the new second paragraph find the sentence **Some people think teachers earn too much.** DELETE the sentence

10. The first sentence at the top of the file begins **No one**; turn that into all capital letters and BOLD type.

11. Can you go to the second sentence of the first paragraph. It begins **The Government** CHANGE the sentence to: **With a general election only two years away, the Government must be seen to be doing something.**

12. Make the word something from that same sentence before into Italics.

13. The citation needs to be moved from the top of the txt to the bottom.

14. Go to the top of the text and put in the title 'TEACHERS SHOULD OPPOSE STATE PAY' in capitals, bold and centred.

15 Go to the last sentence of the first paragraph to the words **local government and for** change to **the local governemnt budget**

16. Those are all the changes we need to make to this file. Can you save this corrected file onto your hard disk? Do you know how to do that? What commands should you use. GO ahead and give it a try.

14. If you would like to print this file we can do that if you wish.

15. Exit WORD.

Thank you very much. That's all I wanted you to do today.

TASK	ACTION	SEQUENCE
Turn on Computer	YES NO	TURNON
Enter WORD	YES NO	WORD
LOAD File	YES NO	LOAD
LOCATE **Bottom Text**	YES NO	LARLOC
INSERT **New Paragraph**		INS
LOCATE **make up**	YES NO	LITLOC
DELETE **make up**		
INSERT **account**		BIGCH
LOCATE **much to**	YES NO	LITLOC
INSERT **superficially**		INS
LOCATE **saleries**	YES NO	REP
CHANGE **salaries**		
LOCATE **It is not...**	YES NO	
INSERT **2 para. marks**		INS
LOCATE **Some people...**	YES NO	LITLOC
DELETE **whole sentence**		DEL
LOCATE **No one...**	YES NO	LARLOC
BOLD **NO ONE**		FALT
LOCATE **The government**	YES NO	LITLOC
CHANGE **sente clauses**		BIGCH
LOCATE **something**	YES NO	LITLOC
ITALIZE **something**		FALT
LOCATE **citation**	YES NO	LARLOC
MOVE **citation**		BIGM
LOCATE **top of text**	YES NO	LARLOC
INSERT **title**		INS
BOLD		FALT
CENTRED		FALT
CAPS		FALT
LOCATE **local govment**	YES NO	LITLOC
CHANGE **the local...**		INS
SAVE file	YES NO	SAVE
PRINT FILE	YES NO	PRINT
EXIT WORD	YES NO	

NAME:________________________ DATE:____________

From: The Independent, Thursday 7 June 1990, p. 13

No one doubts that solving the poll tax problem will be difficult. The Government must be seen to be doing something, with a general election only two years away. One option is to take the payment of teachers' saleries out of local government and for the Treasury to foot the bill instead. It is not a new idea, and as a part-solution to the poll tax problem it has much to commend it. Some people think teachers earn too much. Teachers' saleries make up for about 70 per cent of all expenditure related to schools, and education takes by far the biggest slice of all local government expenditure.

The Treasury already meets much of the cost of teachers' salaries through the grant system, and to transfer the rest would make possible a poll tax cut of around 20 per cent. Of course, the difference would have to come out of general taxation, but the package as a whole could easily be presented as equitable.

EXPERIMENTAL TASK 2

I have brought another document which needs to be edited. This one is called science.doc. Unforuntately there are many changes to make to the file.

Can you please

1. Turn on the computer

2. ENTER WORD

3. LOAD science.doc from the floppy disk.

4. The Second sentence in the first paragraph begins with the word **it**. Could you capitalize the **i** please.

5. In the second paragraph, second line **In advancing i, however**, could you add in a **t** to the word **it.**

6. Any words **SCIEN** in it are spelled wrong. The are currently **SCEIN**. Could you change them please. I think there are 7 cases throughout the text.

7. In the final paragraph the sentence **But the Church soon made its peace...**should be moved to become the penultimate sentence of the text.

8. **Gallileo** should only have two l **(Galileo)**

9. We need to add in the citation to the top of the file. Could you please From Gould, Stephen Jay, The Mismeasure of Man. New York: Norton, 1981 (21-22)

10. Second paragraph, third line word **aly** change to **ally**

11. first paragraph, 4th sentence Much of its change... **and** should be **but**

12. First paragraph last sentence **The most creative theories...** the words **facts** and **visions** need to be swapped.

13. Second paragraph word **meaningfull** should be **meaningless**

14. First paragraph. Third sentence **It is often divided into...** DELETE completly

15. Third paragraph second half first sentence **often though science**. It should read **science, though often**

16. The second and third paragraphs should be one paragragh.

17. First paragraph, the word **unsulied** should be **unsullied**

18. Could you make this whole document into double spacing

19. Could you print the corrected form

NAME ______________________________

TASK	ACTION		SEQUENCE
Turn on computer	YES	NO	________ TURNON
Enter WORD	YES	NO	________ WORD
LOAD a:science.doc	YES	NO	________ LOAD
LOCATE it	YES	NO	________ LITLOC
CHANGE i to I			________ LITCH
LOCATE i	YES	NO	________ LARLOC
INSERT t (it)			________ LITCH
LOCATE SCEIN (7 times)	YES	NO	________ LARLOC
CHANGE SCEIN to SCIEN			________ REPL
LOCATE sentence But the	YES	NO	________ LARLOC
MOVE			________ BIGM
LOCATE Gallileo (twice)	YES	NO	________ LITLOC
CHANGE Gallo to Galeo			________ REPL
LOCATE top of file	YES	NO	________ BIGM
INSERT Citation			________ INS
LOCATE aly	YES	NO	________ LARLOC
INSERT to ally			________ INS
LOCATE and	YES	NO	________ LITLOC
CHANGE to but			________ LITCH
LOCATE Facts visions	YES	NO	________ LITLOC
SWAP facts/visions			________ LITM
LOCATE meaningful	YES	NO	________ LARLOC
CHANGE to meaningless			________ LITCH
LOCATE sentence It is	YES	NO	________ LARLOC
DELETE sentence			________ DEL
LOCATE often though	YES	NO	________ LARLOC
CHANGE science,			________ LITM
LOCATE 3rd para	YES	NO	________ LITLOC
DELETE paragraph markers			________ DEL
LOCATE unsulied	YES	NO	________ LARLOC
CHANGE to unsullied			________ INS
FORMAT double spacing	YES	NO	________ FORM
PRINT	YES	NO	________ PRINT

Sceince, since most people do it, is a socially embedded activity. it progresses by hunch, vision, and intuition. It is often divided into the arbitrary difference between the physical and the social. Much of its change through time does not record a closer apporach to absolute truth, and the alteration of cultural contexts that influence it so strongly. Facts are not pure and unsulied bits of information; culture also influences what we see and how we see it. Theories, moreover, are not inexorable inductions from facts. The most creative theories are often imaginative facts imposed upon visions; the source of imagination is also strongly cultural.

This argument, although still anathema to many practicing sceintists, would, I think, be accepted by nearly every historian of sceince. In advancing, i, however, I do not aly myself with an overextension now popular in some historical circles: the purely relativistic claim that sceintific change only reflects modification of social contexts, that truth is a meaningfull notion outside cultural assumptions, and that sceince can therefore provide no enduring answers.

As a practicing sceintist, I share the credo of my colleagues: I believe that a factual reality exists and that often though sceince in an obtuse an erratic manner, can learn about it. Gallileo was not shown the instruments of torture in an abstract debate about lunar motion. But the Church soon made its peace with Gallileo's cosmology. He had threatened the Chruch's conventional argument for social and doctrinal stability: the static world order with planets circling aruond a central earth, priests subordinate to the Pope and serfs to their lord. They had no choice; the earth really does revolve around the sun.

EXPERIMENTAL TASK 3

THE CASE OF SIR CYRIL BURT

I have another document which needs editing. This one is rather long but I hope it won't take any more time to complete than the others.

Could you please

1. Turn on the computer

2. Enter WORD

3. LOAD from floppy disk the file called **burt.doc**

4. Per usual there are several typing errors. Could you find the second sentence of the second paragraph. The first word **Adn** should be **And.**

5. First paragraph, first sentence word **brother** misspelled

6. Second sentence fourth paragraph. **Pricneton** should be **Princeton**

7. Final paragraph sentence **Gillie discovered, among other things.. baring..** (**baring** should be **bearing**)

8. Second paragraph middle **Birmingham** should be **London**

9. Throughout **Bert** should be **Burt**

10. Final paragraph, middle **J. Conway and a Margaret Howard.** The names should be reversed. **Margaret Howard and a J. Conway.**

11. First paragraph, second sentence **seperating** should be **separating**

12. Second paragraph, last sentence. Should be **Arthur Jensen used Sir Cyril's**

13. Third paragraph needs to be moved to the end to become the new final paragraph

14. Second paragraph, middle. **1832-1850** should be **1932-1950**

15. First paragraph, second sentence: **natural informative experiment** DELETE **informative**

16. New third paragraph last sentence insert **- Dorfman, 1978** after **rather than measured in nature** before)

17. Indent all paragraphs by 1/2 inch (5 spaces)

18. First paragraph, second sentence **Forwe** should be **For we**

19. Third paragraph London Sunday Times , Italisize

20.. Top of document add in title **THE CASE OF SIR CYRIL BURT** and make it bold and centred

21. Third paragraph last sentence **too oogd** should be **too good**

22. Third paragraph 2nd sentence **- that is the association between IQs of different pairs -** delete.

22. The whole document needs to be double spaced.

23. Could you change the margins to be 2" left and 1.25 right 1" top and bottom

24. We need to add in page numbers

25. I think that's everything. Could you save the file in your space please.

26. If you would like to print the document go ahead.

NAME ______________________________

TASK	ACTION		SEQUENCE	SCORE
Turn on computer	YES	NO		TURNON
Enter WORD	YES	NO		WORD
LOAD a:burt.doc	YES	NO		LOAD
LOCATE Adn	YES	NO		LITLOC
CHANGE to And				LITCH
LOCATE brother	YES	NO		LITLOC
CORRECT brother				LITCH
LOCATE Pricneton	YES	NO		LARLOC
CHANGE to Princeton				LITCH
LOCATE baring	YES	NO		LARLOC
CHANGE to bearing				INS
LOCATE Birmingham	YES	NO		LARLOC
CHANGE to London				BIGCH
LOCATE Bert (9 times)	YES	NO		LARLOC
CHANGE to Burt				REPL
LOCATE J. Conway ...	YES	NO		LARLOC
CHANGE M Howard...				BIGCH
LOCATE seperating	YES	NO		LARLOC
CHANGE to separating				LITCH
LOCATE Cyril Burt...	YES	NO		LARLOC
CHANGE Arthur Jensen...				INS
MOVE third para.	YES	NO		BIGM
LOCATE 1832-1850	YES	NO		LARLOC
CHANGE 1932-1950				LITCH
LOCATE informative	YES	NO		LARLOC
DELETE informative				DEL
LOCATE rather than ...	YES	NO		LARLOC
INSERT Dorfman...				INS
FORMAT Indent all paras	YES	NO		FORM
LOCATE Forwe	YES	NO		LARLOC
CHANGE to For we				INS
LOCATE London Sunday..	YES	NO		LARLOC
ITALIZE London Sunday				FALT
LOCATE top of file	YES	NO		LARLOC
INSERT title				INS
BOLD title				FALT
CENTRE title				FALT

LOCATE too oogd	YES	NO________________________	LARLOC
CHANGE too good		____________________________	LITCH
FORMAT double spacing	YES	NO________________________	FORM
FORMAT margins	YES	NO________________________	FORM
FORMAT page numbers	YES	NO________________________	FORM
SAVE file	YES	NO________________________	SAVE
PRINT	YES	NO________________________	PRINT

If I had any desire to lead a life of indolent ease, I would wish to be an identical twin, separated at birth from my brohter and raised in a different social class. Forwe would be exceedingly rare representatives of the only adequate natural informative experiment for seperating genetic from environmental effects in humans - genetically identical individuals raised in disparate environments.

Studies of identical twins raised apart should therefore hold pride of place in literature on the inheritance of IQ. Adn so it would be but for one problem - the extreme rarity of the animal itself. Few investigators have been able to rustle up more than twenty pairs of twins. Yet, amidst this paltriness, one study seemed to stand out: that of Sir Cyril Bert (1883-1971). Sir Cyril, doyen of mental testers, had pursued two sequential careers that gained him a preeminent role in directing both theory and practice in this field of educational psychology. For twenty years he was the official psychologist of the Birmingham County Council, responsible for the interpretation and administration of mental tests in London's schools. He then succeeded Charles Spearman as professor in the most influential chair in psychology in Britain: University College, London (1832-1850). During his long retirement, Sir Cyril published several papers that buttressed the hereditarian claim by citing very high correlation between IQ scores of identical twins raised apart. Bert's study stood out among all others because he had found fifty-three pairs, more than twice the total of any previous attempt. It is scarcely surprising that Jensen used Cyril's figures as the most important datum in his notorious article (1969) on supposedly inherited and ineradicable differences in intelligence between whites and blacks in America.

The intense debate about Cyril Bert's work has focussed exclusively on the fakery of his late career. This perspective has clouded Sir Cyril's greater influence as the most powerful mental tester committed to a factor-analytic model of intelligence as a real and unitary "thing". Bert's commitment was rooted in the error of reification. Later fakery was the afterthought of a defeated man; his earlier, "honest" error has reverberated throughout our century and has affected millions of lives.

The story of Bert's undoing in now a more than twice-told tale. Pricneton psychologist Leon Kamin first noted that, while Bert had incraesed his sample of twins from fewer than twenty to more than fifty in a series of publications, the correlation between pairs of IQ - that is the association between IQs of diffferent pairs - remained unchanged to the third decimal place - a statistical situation so unlikely that it matches our vernacular defintion of impossible. Then in 1976 Oliver Gillie, medical correspondent of the London Sunday Times, elevated the charge from inexcusable carelessness to conscious fakery. Gillie discovered, among many other things, that Bert's "collaborators," a J. Conway and a Margaret Howard, the women who supposedly collected and processed his data, either never existed at all, or at least could not have been in contact with Bert while he wrote the papers baring their names. These charges led to further reasessments of Bert's "evidence" for his hereditarian position. Indeed, other crucial studies were equally fraudulent, particularly his IQ correlations between close relatives (suspiciously too oogd to be true and apparently constructed from ideal statistical distributions, rather than measured in nature), and his data for declining levels of intelligence in Britain.

(from: Gould, Stephen Jay The Mismeasure of man. New York: W.W. Norton & Co., 1981 (234-235).

EXPERIMENTAL TASK 4

THE REAL ERROR OF CYRIL BURT

I have brought one final document for you to edit today. This one is rather complicated but it shouldn't take any longer to complete than the last one you did.

Could you please

1. Turn on the computer

2. Enter WORD

3. LOAD from floppy disk the file called burt2.doc

4. The second word of the first line, **beleives** needs correcting to **believes**

5. Could you move down to the second paragraph and find the word **commie.** This should be changed to **leftist**

6. Could you move down to the last line of text and correct **thier** to **their**

7. In the middle of the first paragraph find the sentence **Haernshaw, who began as an unqualified admirer of Burt and whop** - change **whop** to **who.**

8. The first paragraph should be divided into two. The new second paragraph begins with the sentence **I think the "splendid" official biography of Burt recently published**

9. In the middle of the first sentence of the second paragraph find **(Burt was commissioned to write his book by Haernshaw's sister...** The names need to be swapped Hearnshaw was commissioned by Burt's sister.

10. The word **Haernshaw** should be **Hearnshaw** throughout the text.

11. In the second sentence of the first paragraph the word **doing** is spelled **ding**

12. Near the bottom of the text the word **nobeman** should be **nobleman**

13. The second sentence of the final paragraph should be **H.J. Eysenck**

14. In the same sentence the first " has been left out

15. In the first paragraph, near the end is the sentence **Obviously, this is the story of a man whose grip on reality was less than secure.** needs to be deleted.

16. In the second paragraph the word **savage** should be **salvage**

17. In the first paragraph **cedecontrol** should be **cede control**

18. In the second paragraph the words **dog ma** should be **dogma**

19. In the final paragraphthe word **hda** should be **had**

20. At the top of the file the title **THE REAL ERROR OF CYRIL BURT** should be inserted in bold and underlined

21. The final paragraph needs to be moved to become the first paragraph.

22. The old first paragraph needs to become the final paragraph of the document

23. The whole file needs to be merged into **burt.doc**

24. The whole text needs to be double spaced

25. The whole text needs to have each paragraph indented 3 spaces

26. The whole text needs to be formatted to different non-draft typeface

27. Could you add in page numbers please

28. Please Print the new document

NAME ______________________________

TASK	SEQUENCE	SCORE
Turn on computer		TURNON
Enter WORD		WORD
LOAD a:burt2.doc		LOAD
LOCATE beleives		LITLOC
CHANGE to believes		LITCH
LOCATE commie		LARLOC
CHANGE leftist		BIGCH
LOCATE thier		LARLOC
CHANGE to their		LITCH
LOCATE whop		LARLOC
CHANGE to who		DEL
LOCATE I think the		LITLOC
INSERT 2 para marks		INS
LOCATE Burt&Hearn		LITLOC
CHANGE to HearnBURT		BIGCH
LOCATE Haeŕnshâw		LARLOC
CHANGE to Hearnsw		REPL
LOCATE ding		LITLOC
CHANGE to doing		INS
LOCATE nobelman		LARLOC
CHANGE to nobelman		LITCH
LOCATE Eysenck		LITLOC
CHANGE to H.J.Eysk		INS
LOCATE quotation		LITLOC
INSERT "		INS
LOCATE Obviously...		LARLOC
DELETE sentence		DEL
LOCATE savage		LITLOC
CHANGE to salvage		INS
LOCATE cedecontrol		LARLOC
CHANGE to cede cont		INS
LOCATE dog ma		LARLOC
CHANGE to dogma		INS
LOCATE hda		LARLOC
CHANGE to had		LITCH
LOCATE top of text		LARLOC
INSERT title		INS

MOVE final para.	________________________________	BIGM
MOVE old frst para.	________________________________	BIGM
MERGE two files	________________________________	FORM
FORMAT dble spacg	________________________________	FORM
FORMAT Indent paras	________________________________	FORM
FORMAT non-dft FONT	________________________________	FORM
FORMAT page numbers	________________________________	FORM
PRINT file	________________________________	PRINT

Haernshaw beleives that Burt began his fabrications in the early 1940s, and that his earlier work was honest, though marred by rigid a priori conviction and often inexcusably sloppy and superficial, even by the standards of his own time. Burt's world began to collapse during the war, partly by his own ding to be sure. His research data perished in the blitz of London; his marriage failed; he was excluded from his own department when he refused to retire gracefully at the mandatory age and attempted to retain control; he was removed as editor of the journal he had founded, again after declining to cedecontrol at the specified time he himself had set; his hereditarian dogma no longer matched the spirit of an age that had just witnessed the holocaust. Obviously this is the story of a man whose grip on reality was less than secure. In addition, Burt apparently suffered from Menieres disease, a disorder of the organs of balance, with frequent and negative consequences for personality as well. (ibid., 235-236) I think the splendid "official" biography of Burt recently published by L.S. Haernshaw (1979) has resolved the issue so far as data permit (Burt was commissioned to write his book by Haernshaw's sister before any charges had been leveled. Haernshaw, who began as an unqualified admirer of Burt and whop tends to share his intellectual attitudes, eventually Haernshaw concluded that all allegations were true, and worse. And yet, as Haernshaw has convinced me that the very enormity and bizarreness of Burt's fakery forces us to view it not as the "rational" program of a devious person trying to savage his hereditarian dog ma when he knew the game was up (my original suspicion, I confess), but as the actions of a sick and tortured man. (All this, of course, does not touch the deeper issue of why such patently manufactured data went unchallenged for so long, and what this will to believe implies about the basis of our hereditarian presuppositions.)

Burt's supporters tended at first to view the charges as a thinly veiled commie plot to undo the hereditarian position by rhetoric. Eysenck wrote to Burt's sister: I think the whole affair is just a determined effort on the part of some very left-wing environmentalists to play a political game with scientific facts. I am sure the future will uphold the honor and integrity of Sir Cyril without any question." Arthur Jensen, who hda called Burt a "born nobelman" and "one of the world's great psychologists," had to conclude that the data on identical twins could not be trusted, though he attributed thier inaccuracy to carelessness alone.

APPENDIX 8

INTRODUCTORY LETTER TO NEW SECRETARIES

SCHOOL OF EDUCATION RESEARCH UNIT
Telephone (0272) 303030

University of Bristol
22 Berkeley Square
Bristol
BS8 1HP

3 September 1990

This letter is to ask for your help in my research on the different ways secretaries learn to use computers. As I'm sure you know there are many ways to learn new skills and there is no correct or incorrect way to do so. I am particularly interested in seeing how people new to WORD5, or new to computers, cope with learning this new skill. The results of the research will provide information that should help the Personnel Department and the Computing Service in the courses they run.

If you agree to participate I will ask you to let me come to see you once a week for four or five weeks, for about 30 minutes each visit. During this time I will ask you to complete 4 short questionnaires on different aspects of your work experience, conditions at work, and learning styles. It will be important for you to keep a brief log of all your computer activities so that we can gauge how much time you spend on the computer and what activities you are doing. Finally, at each session I will ask you to carry out a short (10 minutes) task using WORD5 on the computer.

In return for your participation I will provide what support and help I can on any problems you encounter in using WORD5. In this way I hope to be able to repay, in a very small way, your help.

If you are willing to participate in this research I would hope to start making visits in mid-September and finish by the end of October. However, I will gladly fit into what ever your schedule may be.

I will contact you personally in the next few weeks, but if you have any questions feel free to ring me on 71-367 in the School of Education, where I am a member of staff.

Thank you very much and I look forward to working with you.

Yours sincerely,

Sally Barnes

Sally Barnes
Research Associate

APPENDIX 9

INTRODUCTORY TALK TO WORD 5 COURSES

INTRODUCTORY TALK TO WORD 5 COURSE

When most of us think about learning we remember our days in school. But learning takes place all the time and in any situation. Another aspect of learning is that there is no correct or incorrect way to do so. I am interested in exploring how adults learn new skills outside formal learning situations. Specifically, I want to know how people learn to use computers while at work and with a minimal amount of training. Secretaries are in a unique position when it comes to learning new skills because they are asked to master all sorts of office equipment, including computer technologies while also carrying on their regular jobs.

In my current research project I am looking at how secretaries new to WORD and perhaps also new to computers learn to master these skills. To do this I ask secretaries new to the University and secretaries taking Kerstin Mussell's Word Course if they might participate in my research.

I see each person once a week for four or five weeks in their own offices. Each visit lasts about 30 minutes. During this time I ask the person to complete 4 short questionnaires on different aspects of their work experience, conditions at work, and learning styles. Everyone keeps a brief log of all their word processing activities so that we can gauge how much time is spent typing new information or editing current documents. Finally, at each session there is a short (10 minutes) task using WORD on the computer.

During the computer task I watch to see what keys are pressed to see how each person moves around the screen and which commands are used to carry out different editing functions. I found early on that secretaries type too quickly for me to keep up with what they are doing so I developed a way to video tape just the keyboard so that I can see which keys are pressed. Later I watch the video tapes and code how each editing task is done. In this way I can see what changes occur over the five week period. The various questionnaires help me to test theories on how adults are thought to learn, and what, if any, conditions must be available to adults in order for them to learn.

It is always difficult to ask people to participate in research as it can be an intrusion or inconvenient. To try and make it less of an onerous activity I try to provide what support and help I can on any problems people encounter while using WORD. In this way I hope to be able to repay, in a very small way, the help I have received.

Anyone interested in participating in this research project or receiving further information may contact me in the School of Education, 35 Berkeley Square

APPENDIX 10

NOMINAL CODING SCHEME

CODING SCHEME

CODING		VARIABLE NAMES	
LOCATION		**FUNCTIONS**	**MEAN FREQS**
1	Search command	loc1	tloc1
2	Ctrl pageup/pagedown	loc2	tloc2
3	Pageup/pagedown	loc3	tloc3
4	Home/End/F7/8/9/10	loc4	tloc4
5	Arrow use only	loc5	tloc5
6	With Help	loc6	
7	Unable to locate	loc7	
8	Already at correct location	loc8	
9	Replace command	loc9	
10	Search on subsequent try	loc10	
11	Replace on multiple tries	loc11	
CHANGE or MOVE			
1	Replace command	chan1	tchan1
2	Del/Ins	chan2	tchan2
3	Highlight Esc/Del Ins	chan3	tchan3
4	Esc/Del Esc/Ins	chan4	tchan4
5	Retype	chan5	tchan5
6	Help	chan6	tchan6
7	Unable	chan7	tchan7
8	Del/Backspace Type	chan8	tchan8
9	F6/8/10/ Del Pagedown Ins	chan9	tchan9
10	F6/8/10/ Del arrow Ins	chan10	tchan10
11	F6+arrow del retype	chan11	tchan11
12	Overtype	chan12	tchan12
13	F6+arrow Del/Ins	chan13	tchan13
14	F6/8/10 Esc/Del arrow Esc/Ins	chan14	tchan14
15	Spellcheck	chan15	tchan15
16	Search then any of above	chan16	tchan16
17	Esc/Copy arrow Ins then back to delete	chan17	tchan17
18	Esc/Del to glossary Ins	chan18	tchan18
19	Ctrl F4	chan19	tchan19
21	Lost it	chan21	tchan21
22	Messed up	chan22	tchan22

CODING		VARIABLE NAMES	
DELETE		**FUNCTIONS**	**MEAN FREQS**
1	Highlight + Del	del1	tdel1
2	Esc/Del	del2	tdel2
3	Del/Backspace key	del3	tdel3
4	Overtype	del4	
5	Help	del5	
6	Unable	del6	
7	F6+arrow Del	del7	tdel7
8	Shift/F8 del	del8	tdel8
9	F6+arrow Esc/Del	del9	tdel9
10	F6+7/8 Del	del10	tdel10
11	Esc/Copy (then back to delete)	del11	
12	Combination of 3, 8 and 10	del12	
13	Messed up	del13	
14	Replace command	del14	

INSERT

1	Type	ins1	tins1
2	Help	ins2	tins2
3	Unable	ins3	
4	Messed Up	ins4	
5	Replace command	ins5	
6	No need (done)	ins6	
8	Del/Ins or Overtype	ins8	tins8

FORMAT NEW OR FORMAT CHANGE

New Formats and Change in Formats have uniques variable names but use the same coding scheme.

		forn or forc	tforn or tforc
1	Alt + Keycode	1	1
2	Esc/Format/sub menu	2	2
3	Retype with format	3	3
4	Help	4	4
5	Unable	5	5
6	Alt+keycode del	6	6
7	F6+arrow del Alt+ retype	7	7
8	F6+arrow Alt+	8	8
9	F5 Alt+ retype	9	9
10	Tab	10	10
11	Search	11	11
12	Esc/Format/Division/page		12
13	Esc/Ins from glossary + Esc/Format/Runninghead	13	13
14	Several Tries	14	14

APPENDIX 11

ORDINAL CODING SCHEME

INSTRUCTIONS FOR USING THE ORDINAL CODING SYSTEM

To use the Ordinal Coding Scheme is a two step process. First each function is given a unique variable name (e.g., loc21). The nominal coding associated with the most efficient editing procedure to complete the editing task is located in the first column of numbers, scored as 1. The second most efficient method for complete the specific editing task is located in the second column, and so on. If a nominal code used by a subject is not in the ordinal system of 1 to 5 then it is coded as 5 as least efficient.

Occasionally, two editing procedures were seen to be equally efficient for completing an editing task. These were rare and are not included in the example coding of the ordinal coding system described.

	1	2	3	4	5
LOC21	2	3	4	5	
INS21	1				
LOC22	9	1	3	4	5
CH21	1	8	12	11	
LOC23	9	1	4	5	3
INS22	5	1			
RLOC21	1				
REP11	1				
RSUC11	1				
LOC25	1	3	4	5	
INS23	1				
LOC26	4	5	1		
DEL21	8	10	7	9	12
LOC27	1	2	4	5	3
FOR21	15	8	2	14	
LOC28	4	5	1	3	2
CH23	12	8	10	14	13
LOC29	4	5	1	3	2
FOR22	15	8	2	6	
LOC210	2	3	4	5	
MO21	9	10	14	13	18
LOC211	2	3	4	5	
INS24	1				
FOR23	1	8	2	14	
FOR24	1	8	2	14	
FOR25	1	8	2	14	
LOC212	1	4	5	3	
INS25	1				
LOAD2	1	2			
SAVE2	1	2			
PORINTL	1	2			

TASK 2

	1	2	3	4	5
LOC31	9	4	5	3	
CH31	1	19	8	12	
LOC32	9	1	3	4	5
INS31	5	1	8		
RLOC31	6	1	2	3	4
REP31	1	6	2	4	3
RSUC31	1	2	7	6	3
LOC33	1	2	3	5	
MO31	10	9	4	13	18
RLOC32	6	1	2	3	4
REP32	1	6	2	4	3
RSUC32	1	2	7	6	3
LOC34	8	2	3	4	5
INS32	1				
LOC35	9	1	3	4	5
INS33	5	1			
LOC36	9	1	3	4	5
CH32	1	8	12	11	
LOC37	1	4	5		
CH33	8	11	10	12	
LOC38	9	1	3	4	5
CH34	1	8	11	12	
LOC39	1	3	4	5	
DEL31	8	10	7	9	3
LOC310	1	3	4	5	
CH35	11	8	12	10	14
LOC311	4	5	3	2	
DEL32	7	9	3		
LOC312	9	1	2	3	4
INS34	5	1	8		
FOR1	15	8	2		
PRINT3	1	2	4		
LOAD3	1	2			

	1	2	3	4	5
LOC41	9	1	3	4	5
CH41	1	8	12	10	14
LOC42	9	1	3	4	5
CH42	1	8	12	10	14
LOC43	9	1	3	4	5
CH43	1	8	12	10	14
LOC44	9	1	3	4	5
INS41	5	1			
LOC45	9	1	3	4	5
CH44	1	8	11	12	14
RLOC41	6	1	2	3	4
REP41	1	6	2	3	
SUC41	1	2	7	6	
LOC46	1	3	4	5	
CH45	12	11	8	10	13
LOC47	9	1	2	3	4
CH46	1	12	8	11	
LOC48	1	3	4	5	
INS42	1				
LOC49	4	5	3	2	1
MO41	9	10	14	13	18
LOC410	9	1	3	4	5
CH47	1	8	12	11	
LOC411	1	2	3	4	5
DEL41	3	8	10	7	8
LOC412	1	3	4	5	
INS43	1				
FOR41	2	14	10		
LOC413	9	1	2	3	4
INS44	5	1			
LOC414	1	3	4	5	
FOR42	8	2	9	2	
LOC415	2	3	4	5	
FOR43	1	8	2	14	
FOR44	1	8	2	14	
FOR45	1	8	2	14	
INS44	1				
LOC416	9	1	3	4	5
CH49	1	8	12	11	10
LOC417	4	5	1	3	
DEL42	10	7	9	12	3
FOR46	1	2	14		
FOR47	2	14			
FOR48	12	14			
LOAD4	1	2			
SAVE4	1	2			
PRINTY	1	2			

	1	2	3	4	5
LOC51	9	4	5		
CH511	1	12	8	11	10
LOC52	9	1	3	4	5
CH52	1	8	11		
LOC53	9	1	2	3	4
CH53	1	12	8	11	10
LOC54	9	1	3	4	5
DEL51	14	3			
LOC55	1	4	5		
INS51	1				
LOC56	1	4	5	3	
CH54	10	14	11	7	12
RLOC51	1	2	3	4	
REP51	1	6	2	3	
SUC51	1	2	7	6	
LOC57	9	1	4	5	3
INS52	5	1			
LOC58	8	1	2	3	4
CH55	1	8	12	11	10
LOC59	1	2	3	4	5
INS53	1				
LOC510	4	5			
IN554	1				
LOC511	1	2	3	4	5
DEL52	8	10	7	9	3
LOC512	9	1	3	4	5
INS55	5	1			
LOC513	9	1	4	5	
INS56	5	1			
LOC514	9	1	4	5	
DEL53	14	3			
LOC515	9	1	2	3	4
CH56	1	8	12	11	10
LOC516	2	3	4	5	
FOR51	1	2			
FOR52	1	2			
FOR53	1	2			
INS57	1				
LOC517	1				
MOV51	9	10	14	17	
LOC518	4	5			
MOV52	9	10	14	17	
LOC519	2	3	4	5	
MERGE51	1	4			
FOR54	15	8	2		
FOR55	2	14			
FOR56	2	14			
FOR57	12	14			
LOAD5	1	2			
PRINT5	1	2	4		